FluxReader Validation

FluxReader+dk2nu, NovaBeamMat

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NOvA Collaboration meeting, October 23, 2014

Introduction

- Goals: Check FluxReader outputs, comparing to older scripts; and give a beginner's perspective on user experience
- Studied flux files in dk2nu format from

  `/nusoft/data/flux/dk2nu/nova/2013/flugg_mn000z200i_peanut_lowth/`
- Compared to results with Ioana's NovaBeamMat (see e.g. Link1 Link2)

  `/nova/ana/users/rschroet/flugg_fluxes/flugg_mn000z200i_peanut_lowth/`
- Histograms generated with same binning; 300 files each; energy spectra normalized to 1/POT
- POT :
  NovaBeamMat: 1.4253 e+08
  FluxReader: 1.46806 e +08
- Thanks to the NOvA Beam group. Special thanks to Ioana and Gareth!

First presentation: Nova docdb 12091

Checks

- ✓ Documentation: Tutorial video, Demos, Technical note, Redmine
- ✓ Read 1:1 from dk2nu (new: detector location from dk2nu txt file)
- For 1D energy spectra
  - ✓ POT number
  - ✓ Classification by particle type, parent type and sign
  - ✓ Combiner
  - ✓ Cross section applied
  - ✓ No weights, external weights
- ✓ Cross sections
- ✓ pTpz 2D histograms

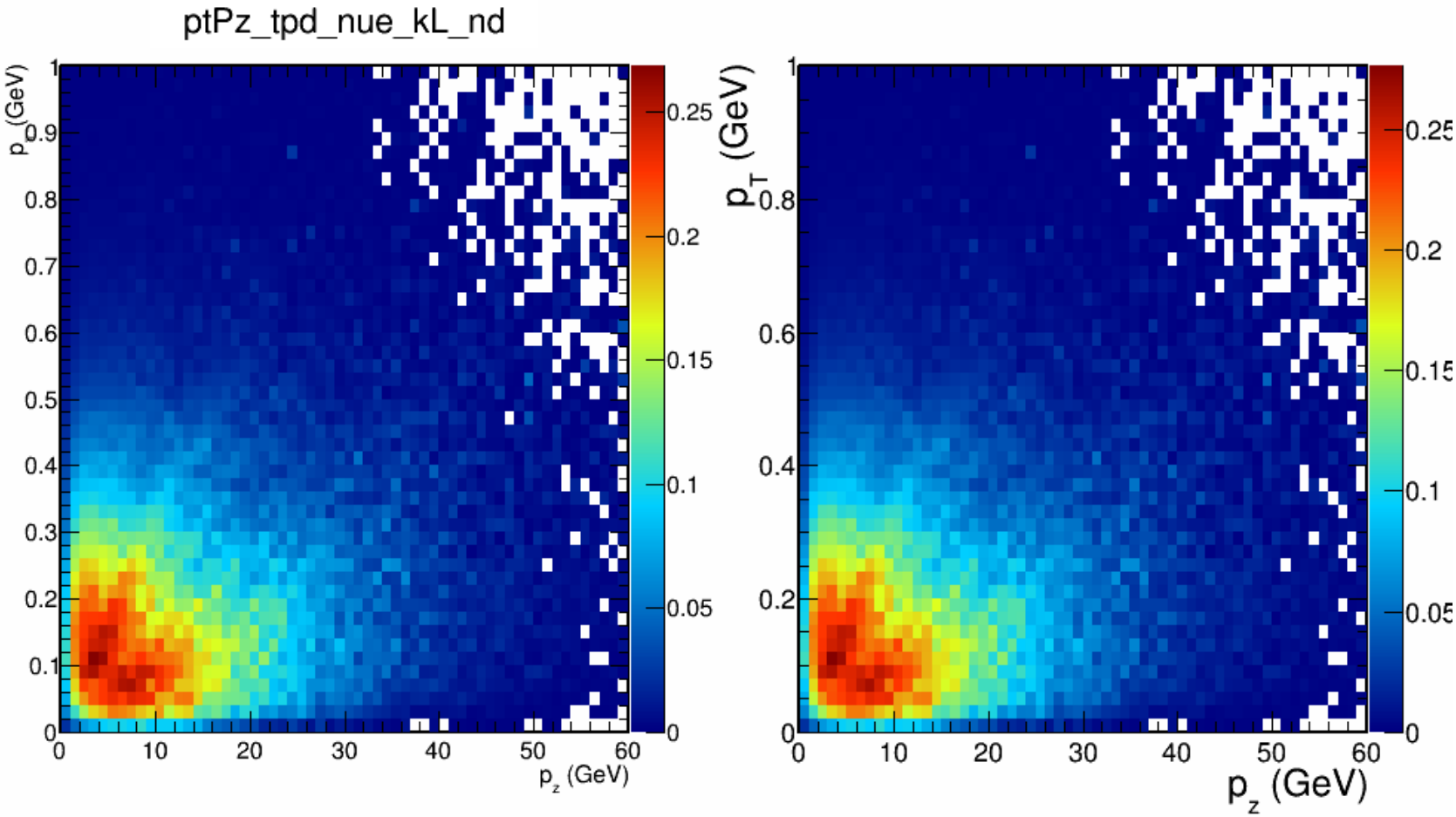
Section 1

2D histograms

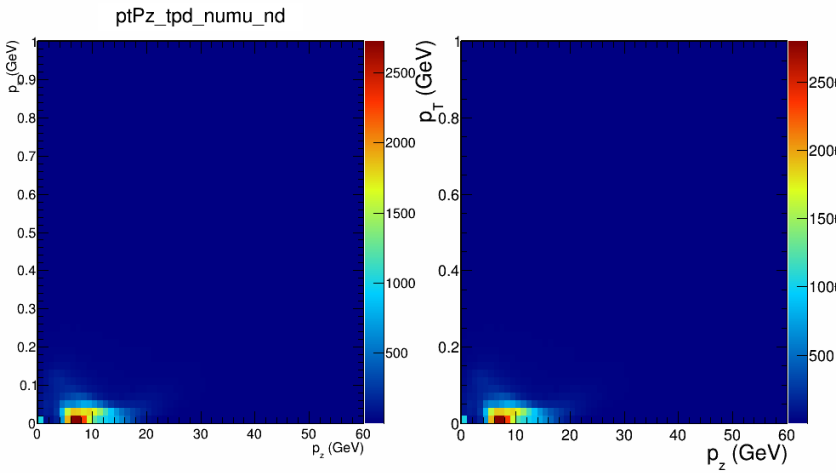
Notes

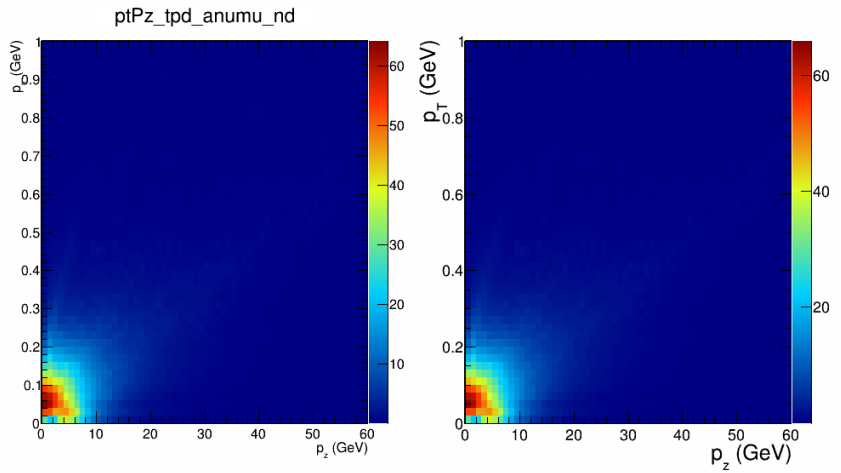
- Last time: right-out-of-the-box ptpz distributions with FluxReader /NovaBeamMat looked different
- One was plotting parent ptpz; the other ancestor ptpz
- Easy fix in my code. Now everything looks ok.
- Checked other sources of discrepancy. No bugs to report!
- Remark: pt/pz variables for ancestors are defined (commented) in FluxReader's Vars.h . Can't use them since this set of dk2nu trees don't have filled the ancestor branch (original Flugg files do have the data).
- Plotting: pdpt, pdpz: Momentum of the ν parent at the ν production vertex

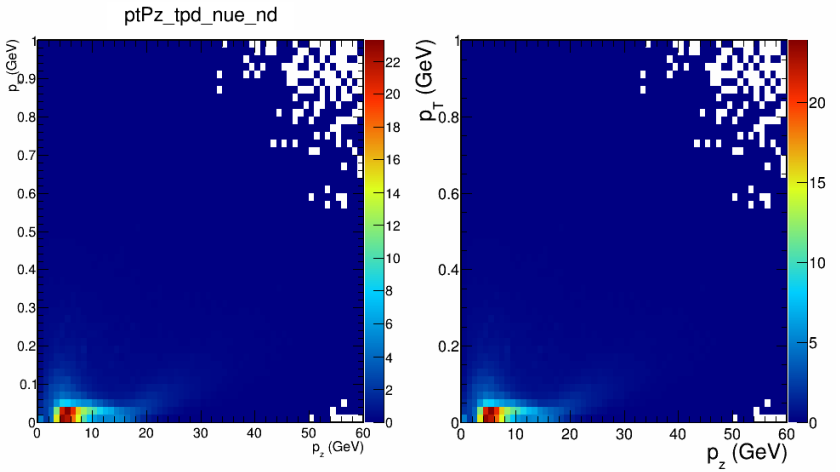
Parent ptpz; NBM (left) FxR (right)

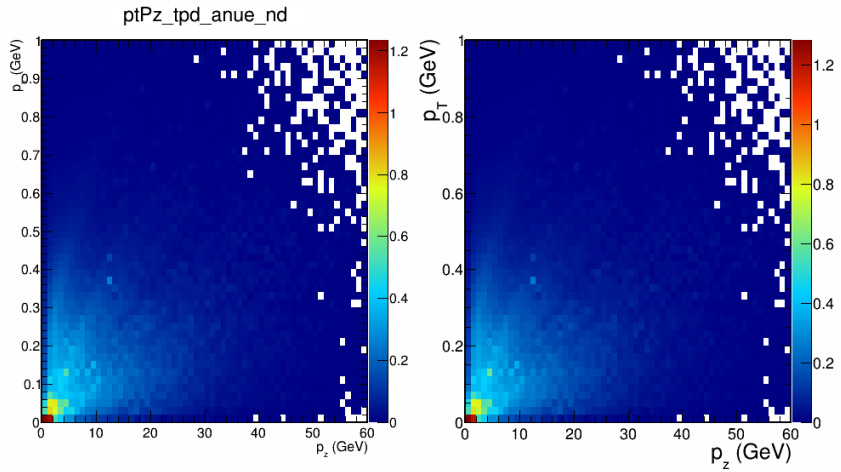


Parent ptpz; NBM (left) FxR (right)







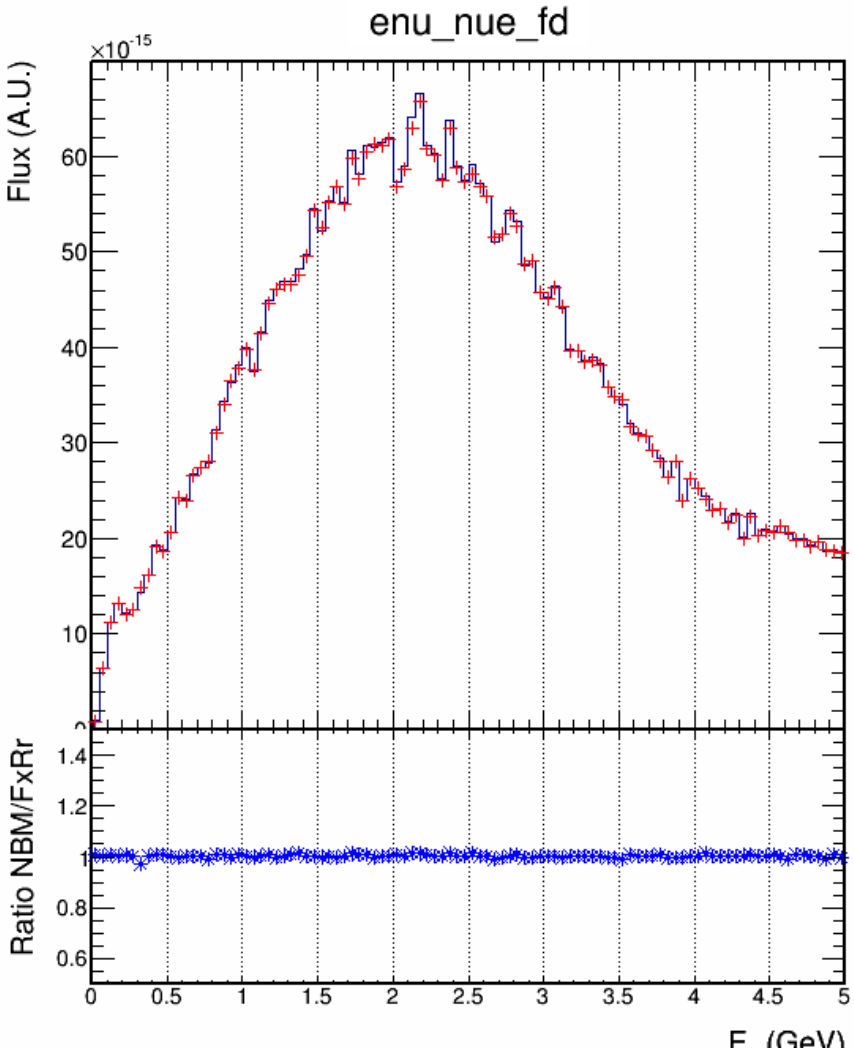


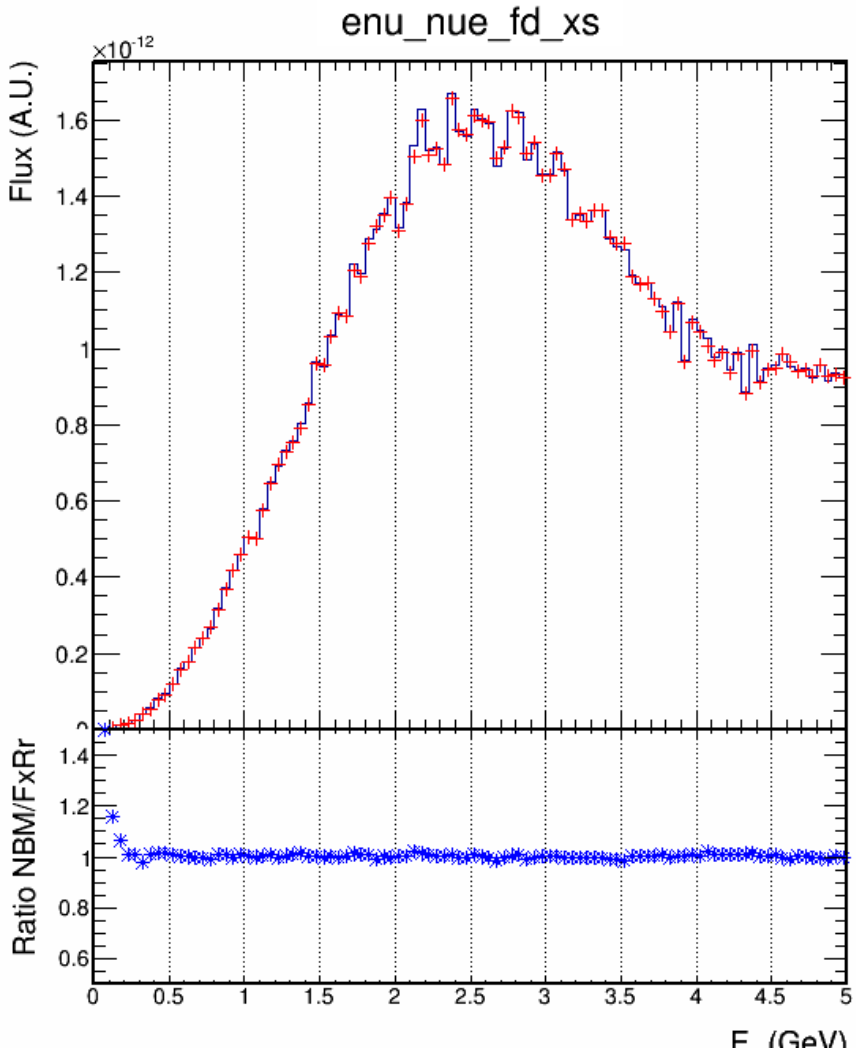
Section 2

Cross section

Observation (1)

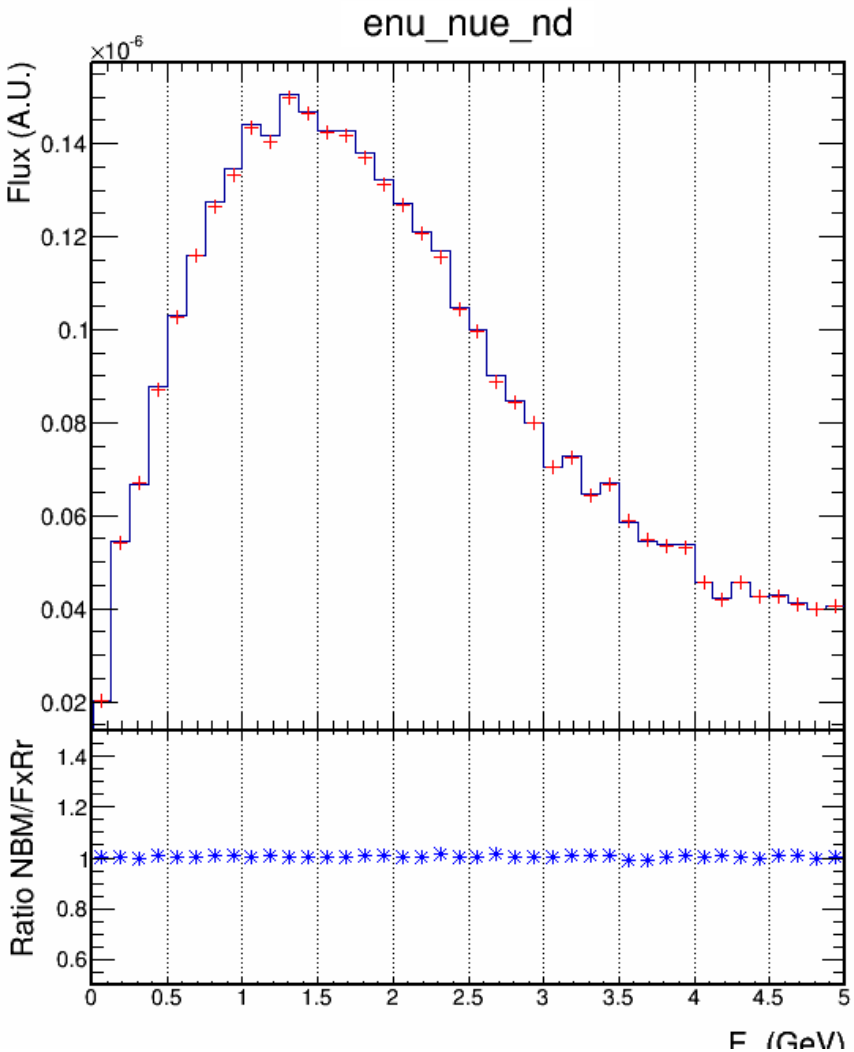
Notice how the ratio in the 0-0.5 GeV energy range changes after applying cross sections

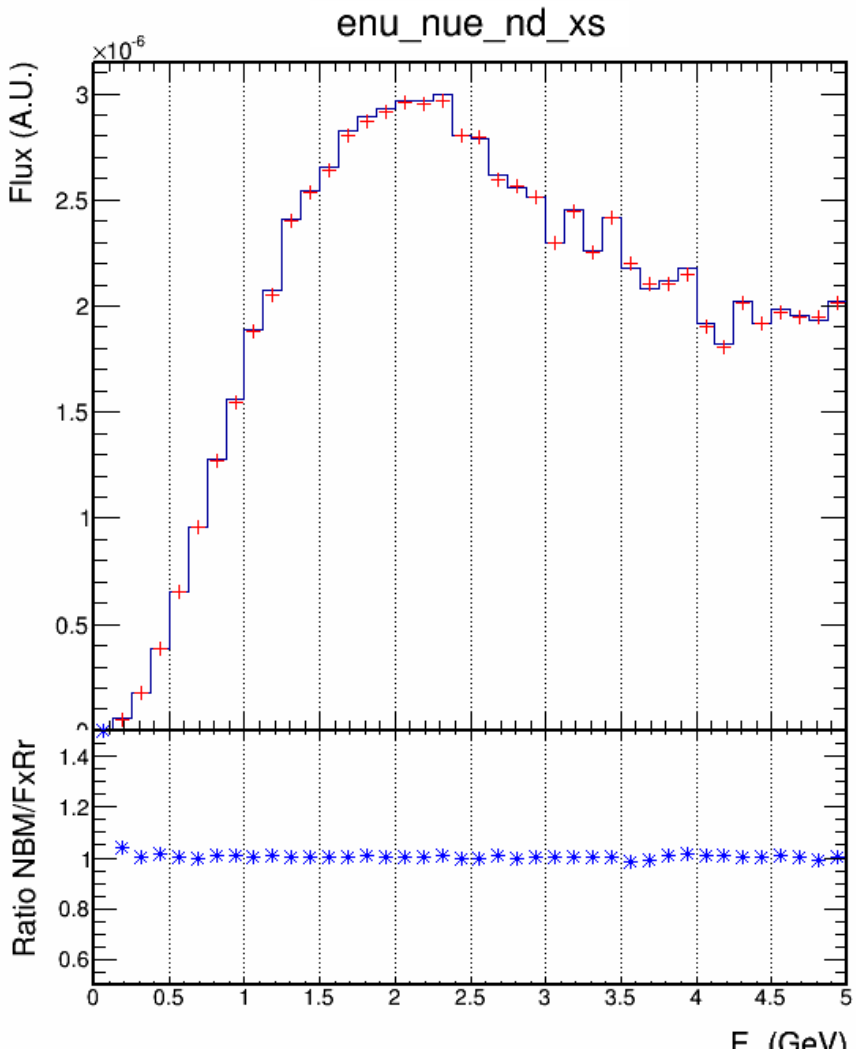




Observation (2)

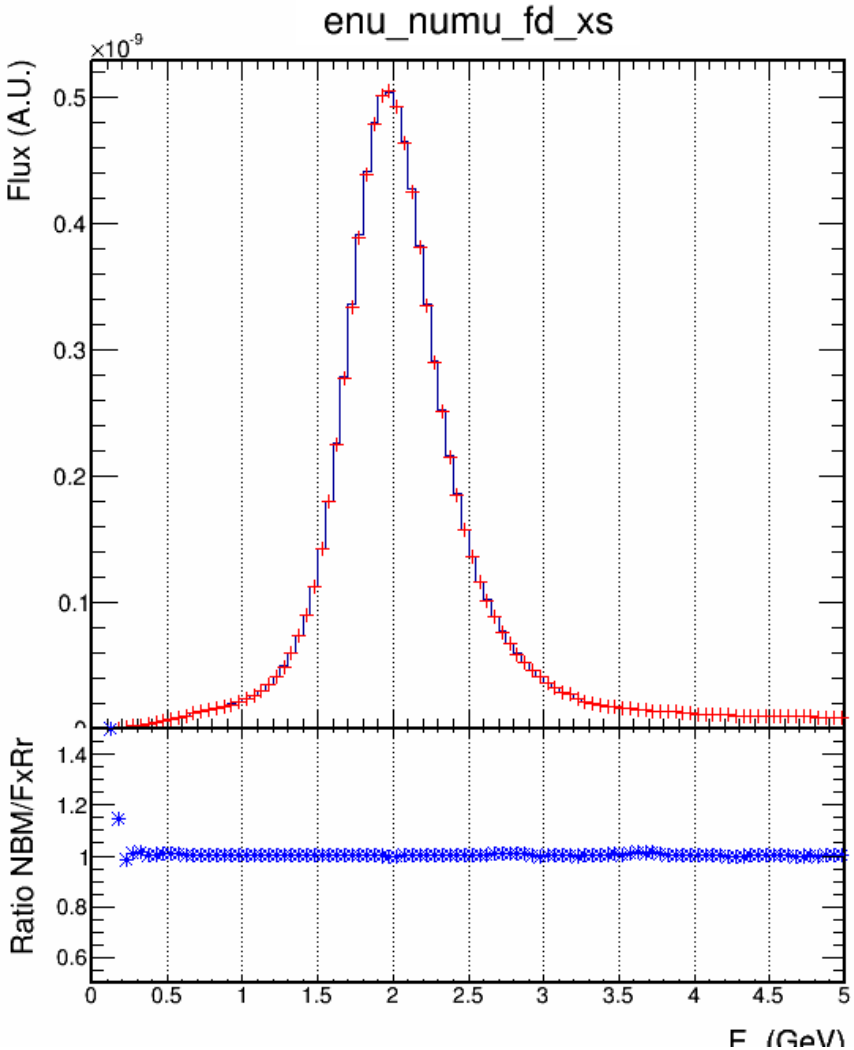
More noticeable for FD since binning is smaller

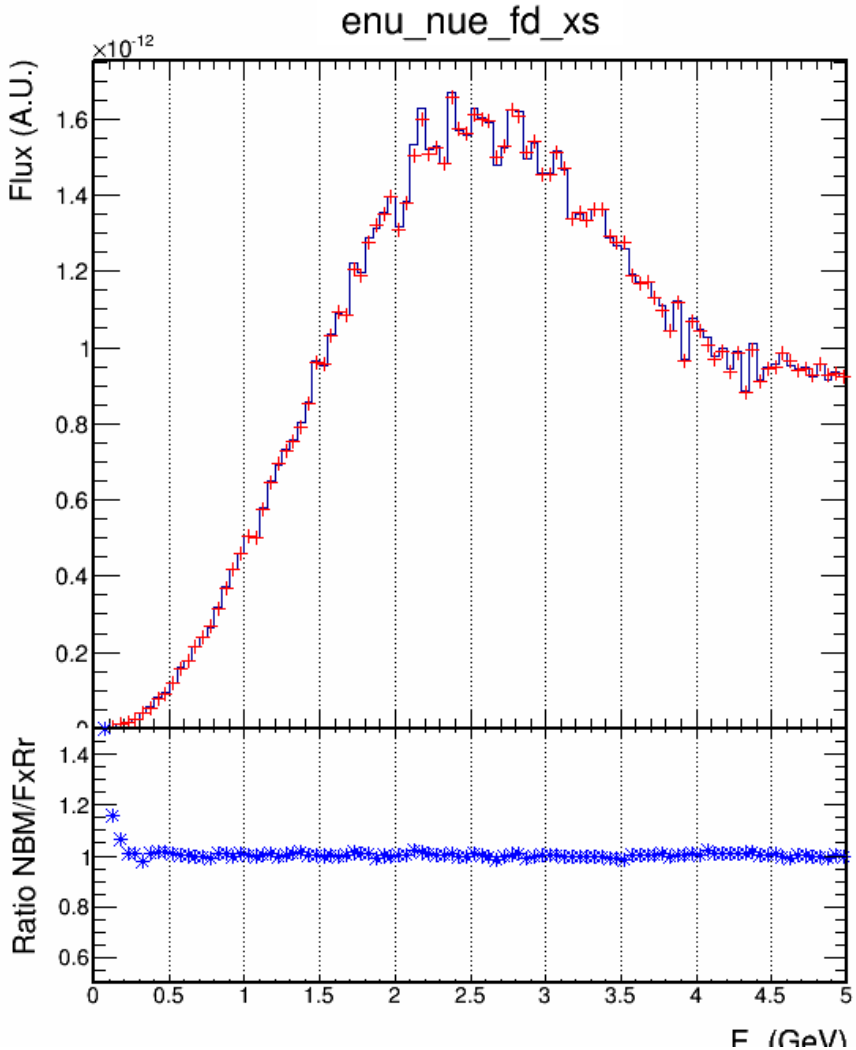




Observation (3)

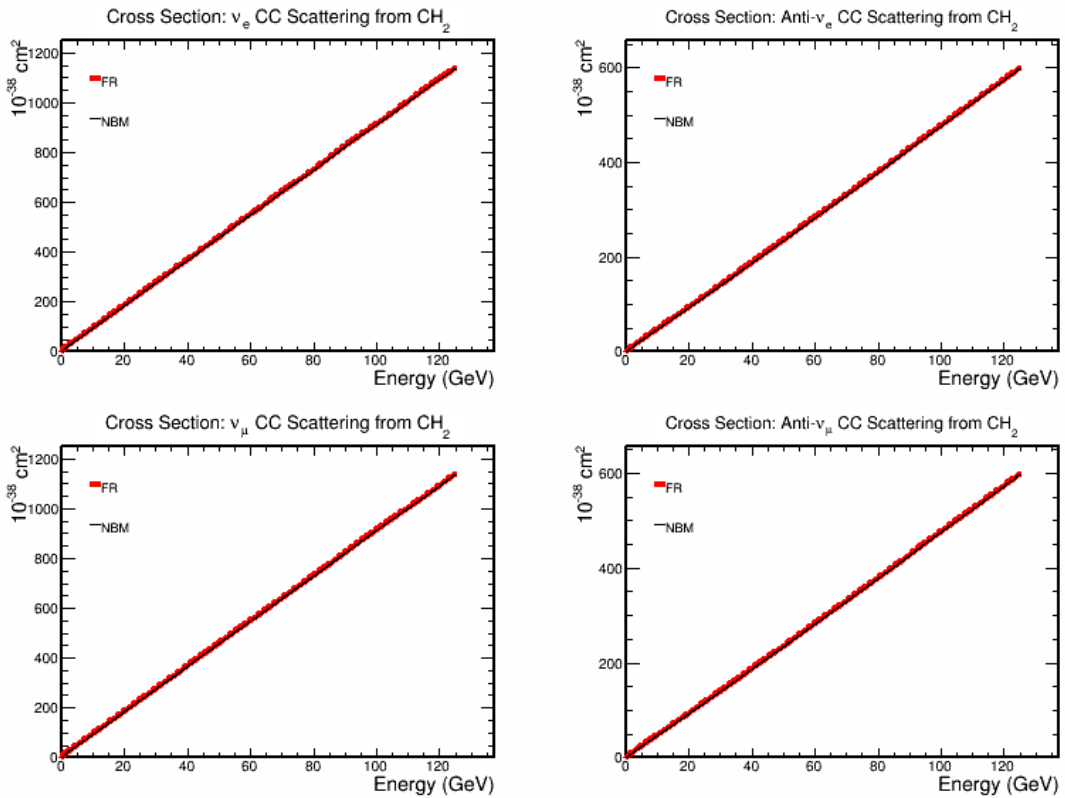
Affects all neutrino types





Notes

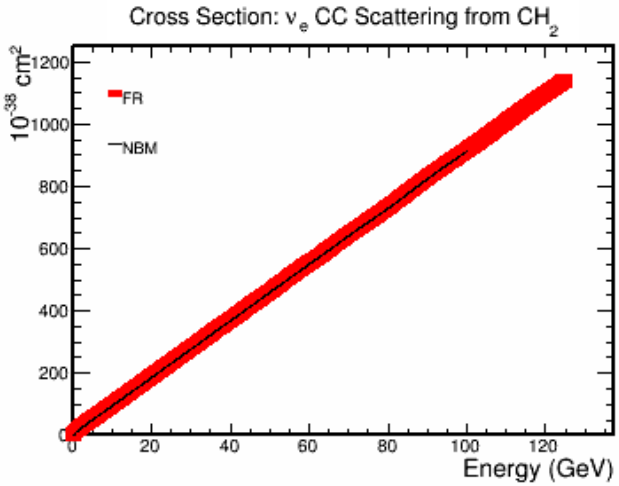
- Both FluxReader and NovaSoft read the cross section information from a file in $GENIEXSECPATH (always the most recent version).
- Graphs appear to be the same

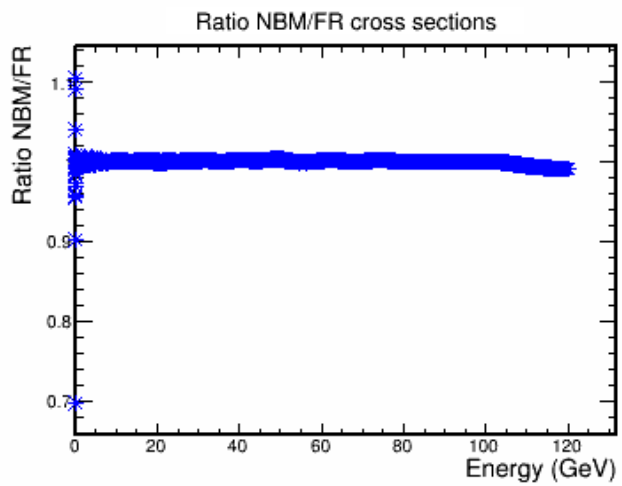


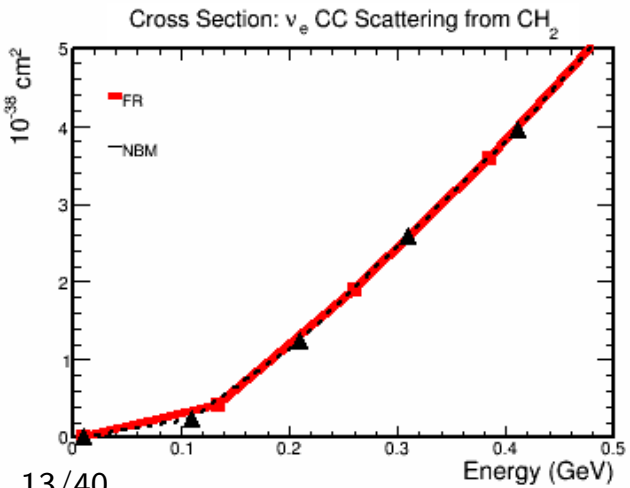
Notice the pretty labels, incl. scale factor :)

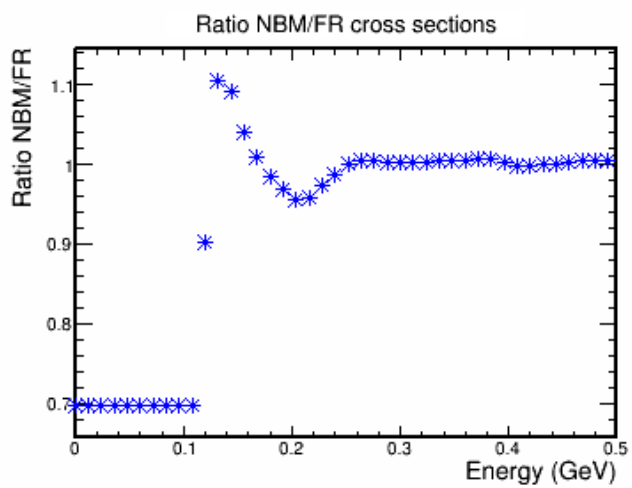
Cross sections and ratios

- Comparing stored TGraphs. Number of points for a given interval is different $\rightarrow$ different interpolation; effect more pronounced near 0. Here: linear interpolation
- Values are usually small. Is this a concern?









Section 3

Conclusion

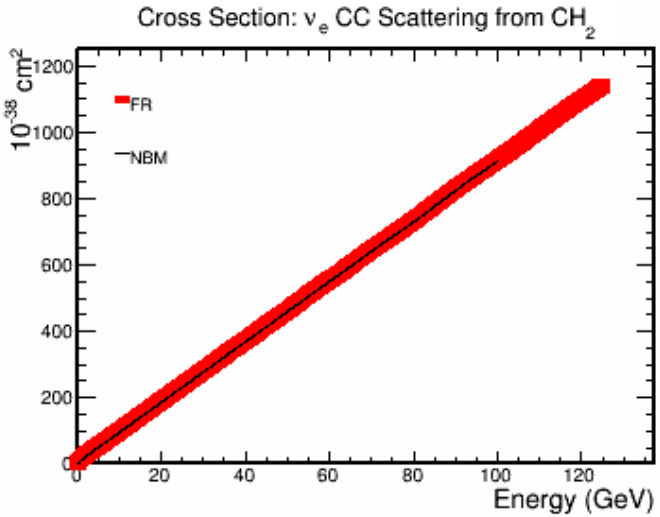
Conclusion

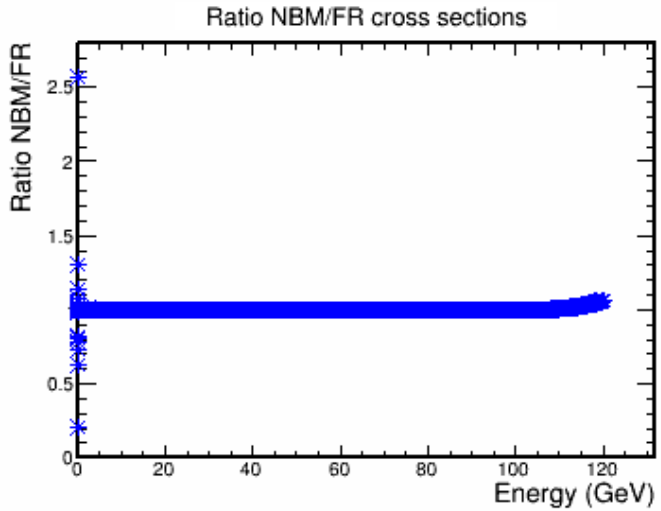
- All features compared between FluxReader and NovaBeamMat look fine. FluxReader is more versatile.
- Package is very user-friendly: code is clean and clear, documentation is outstanding!
- All issues/ comments have been resolved promptly $\rightarrow$ kudos!
- Last suggestions:
  - Detector::Print()
  - Human-readable units, e.g. Flux in Events/6×10^{20} POT/ cm^2/Energy bin, absolute event rate
  - Simple plotting tools, e.g. Fluxes by neutrino type and total, two types of flux + ratio, FD/ND ratio + double ratio.
- A comparison for G4NuMi is also a good idea, since the decay chain is coded differently

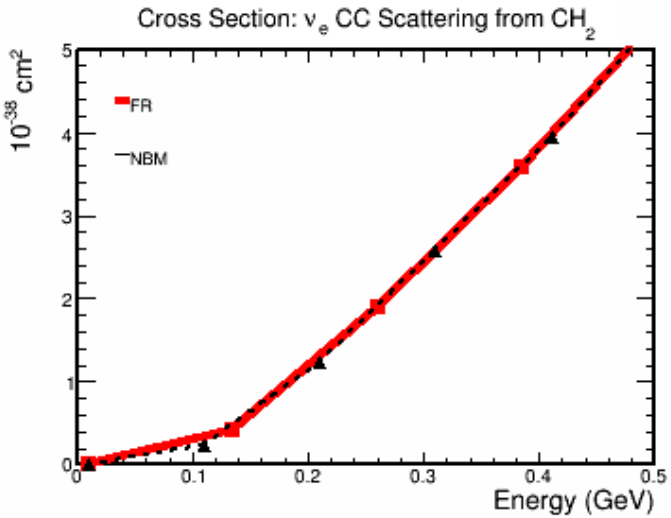
Section 4

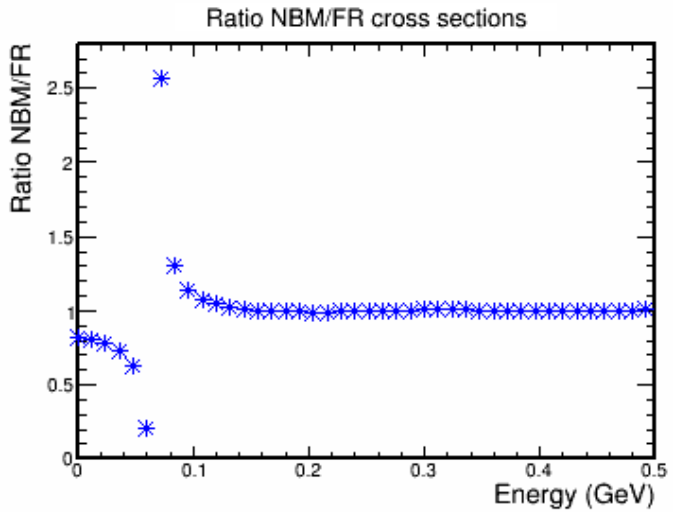
Backup

Cross section graphs: Using spline for interpolation

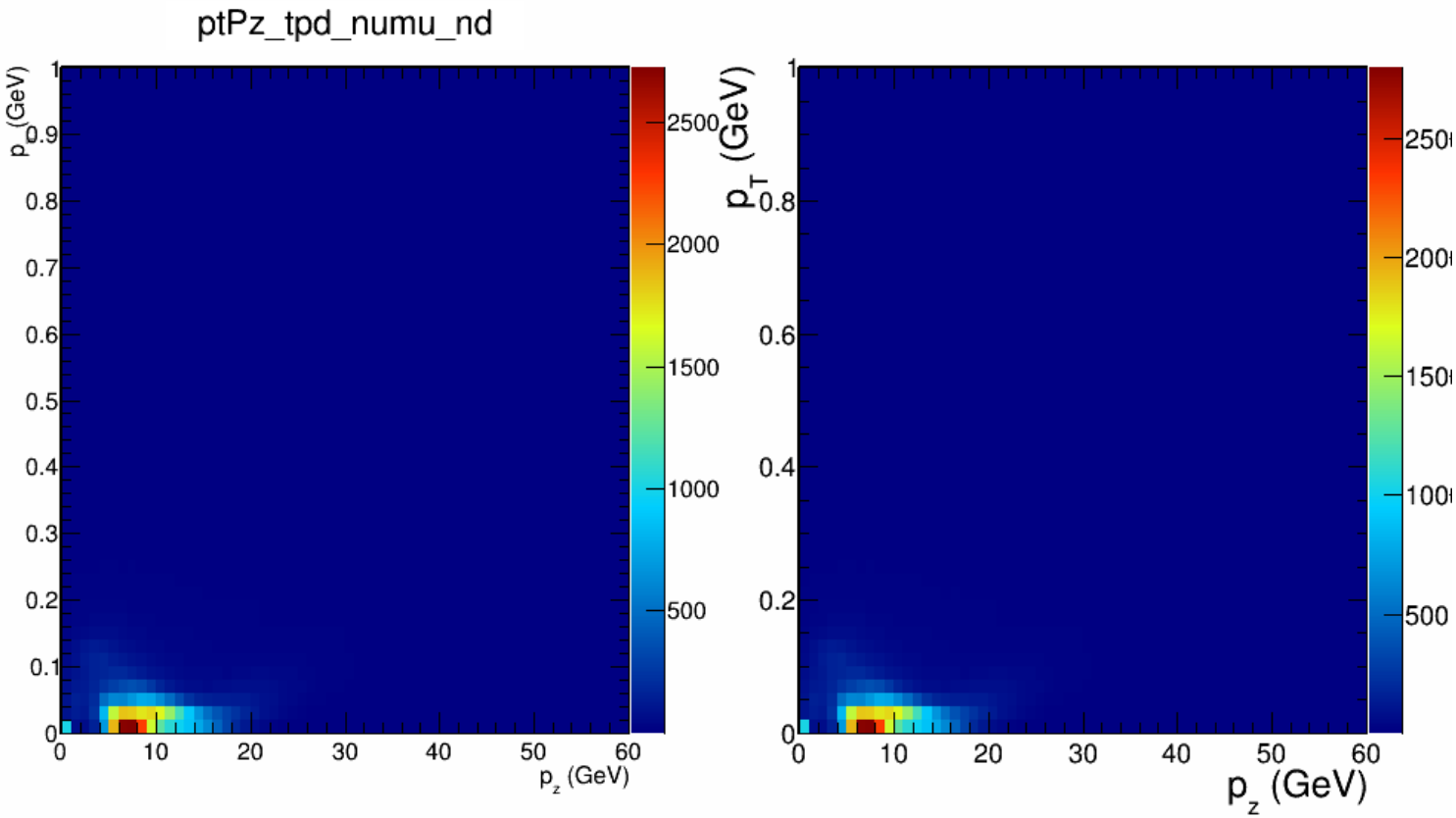








NBM (left) FxR (right)



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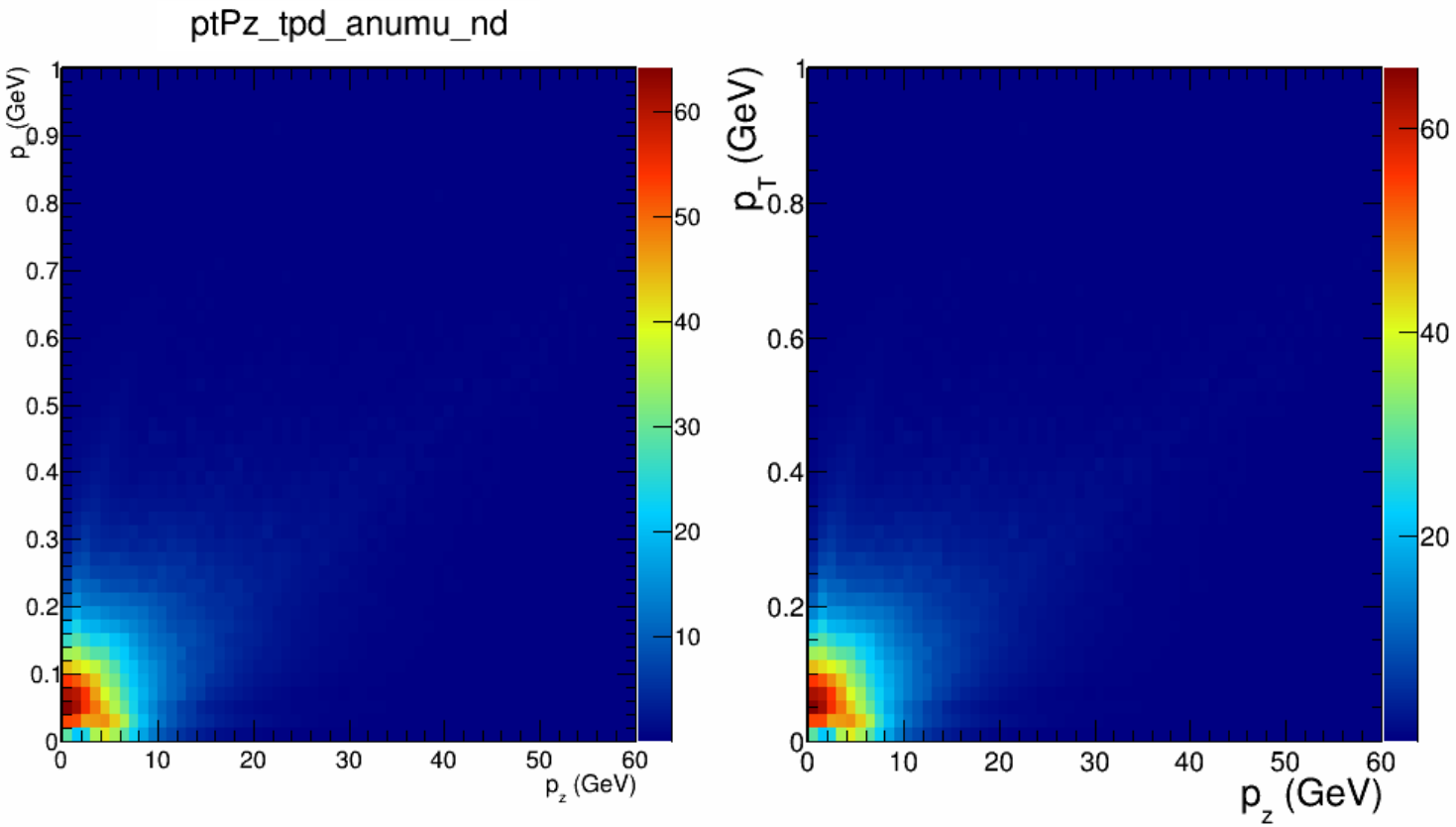

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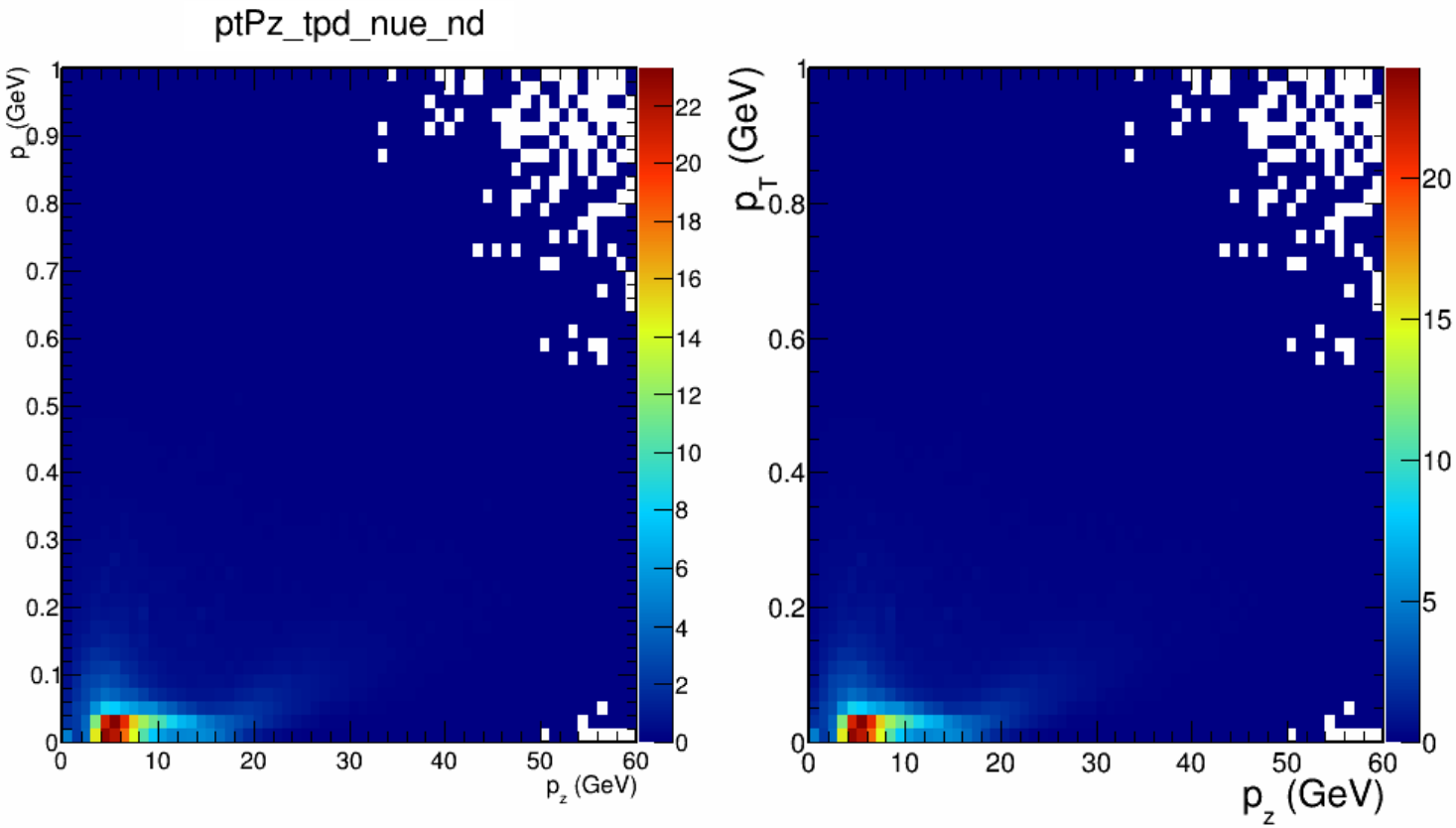

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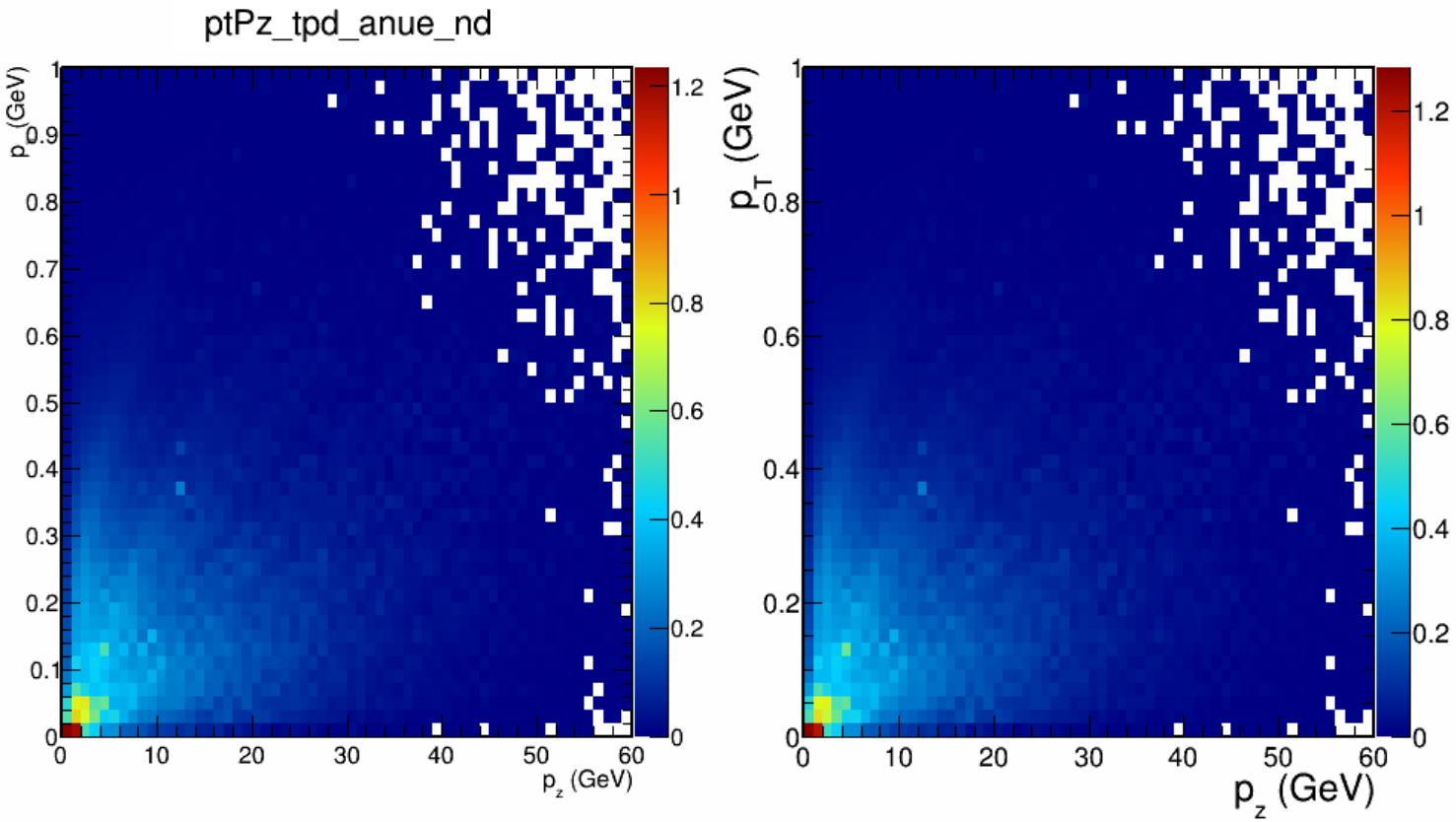

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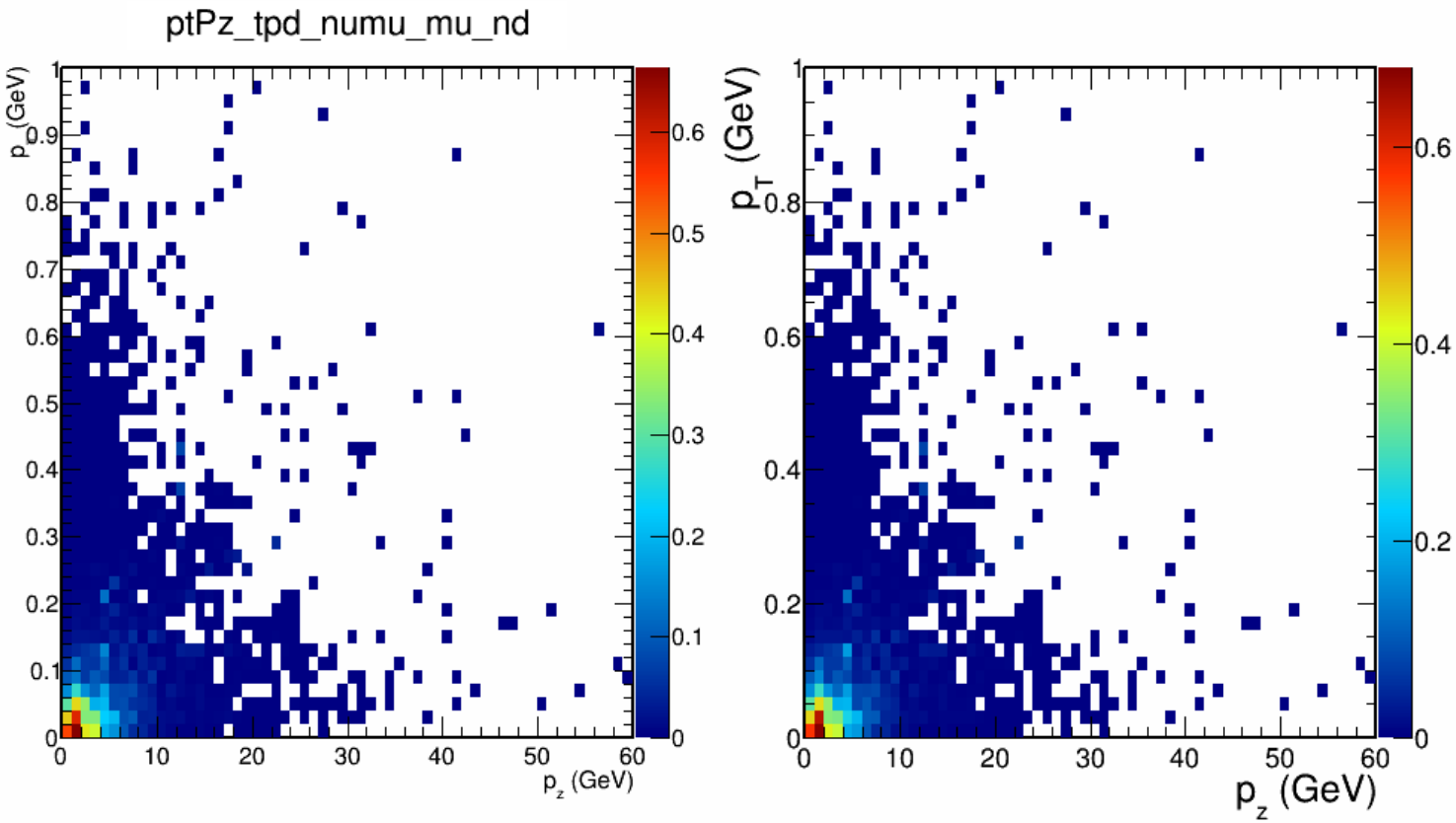

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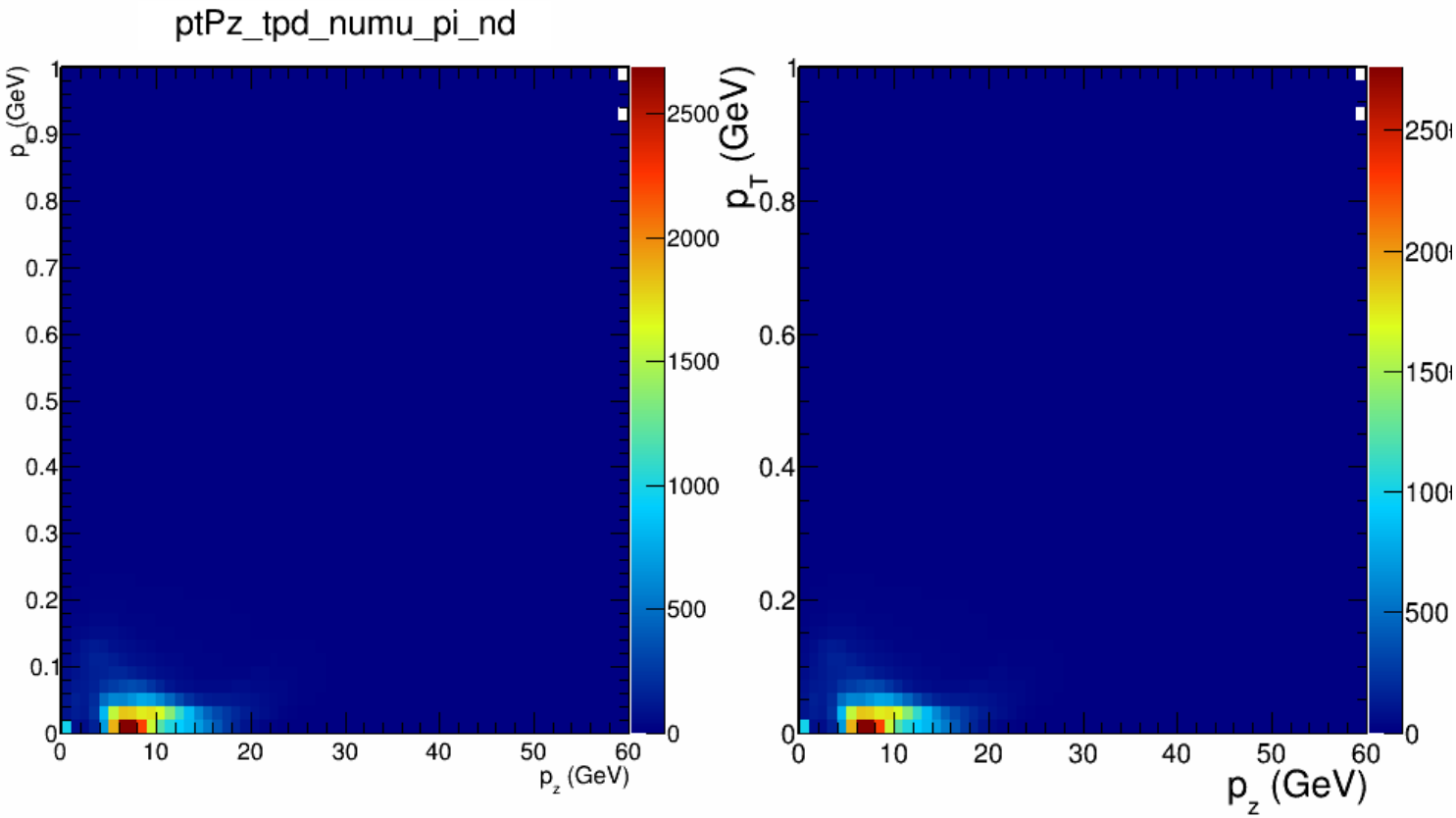

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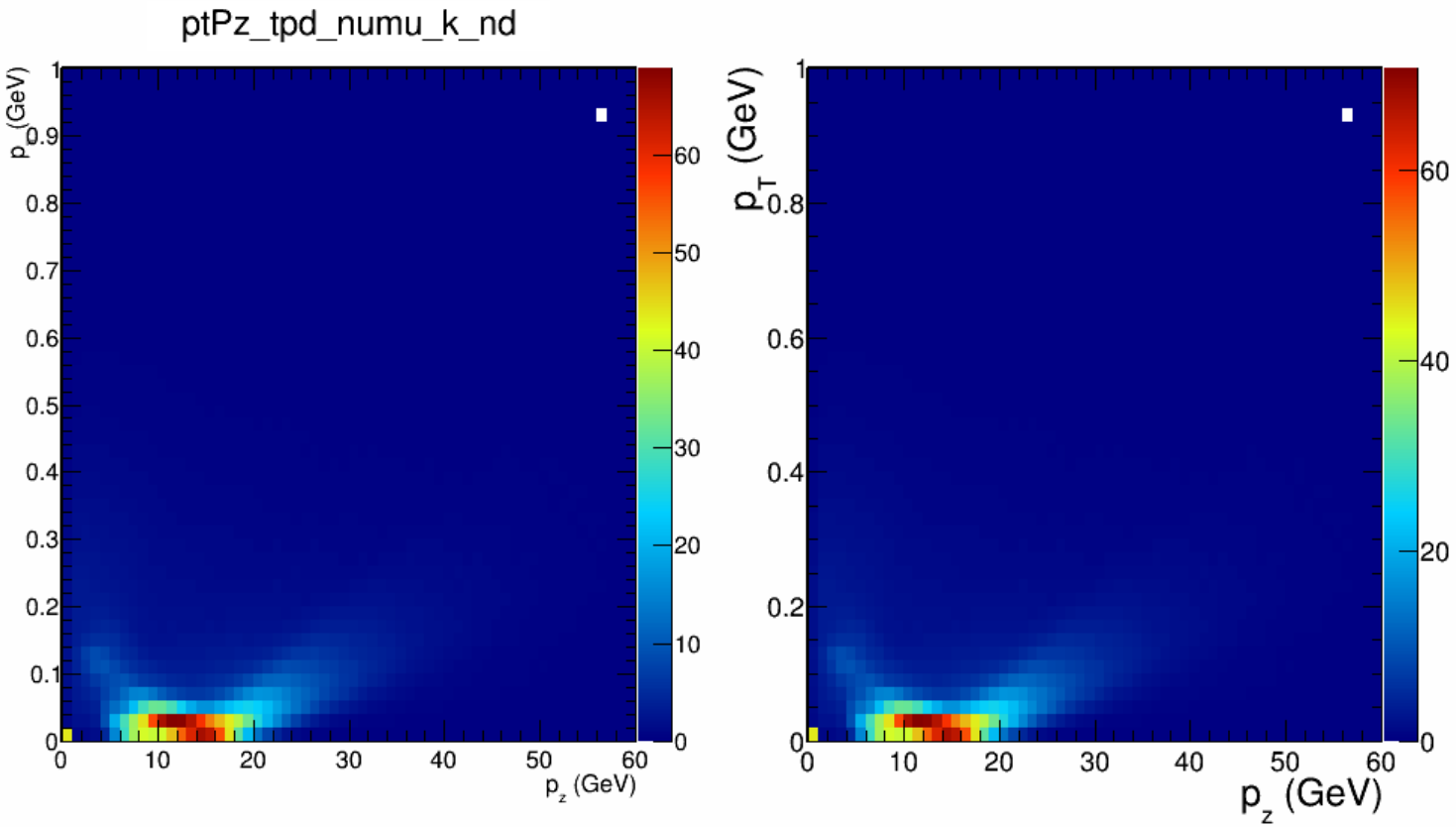

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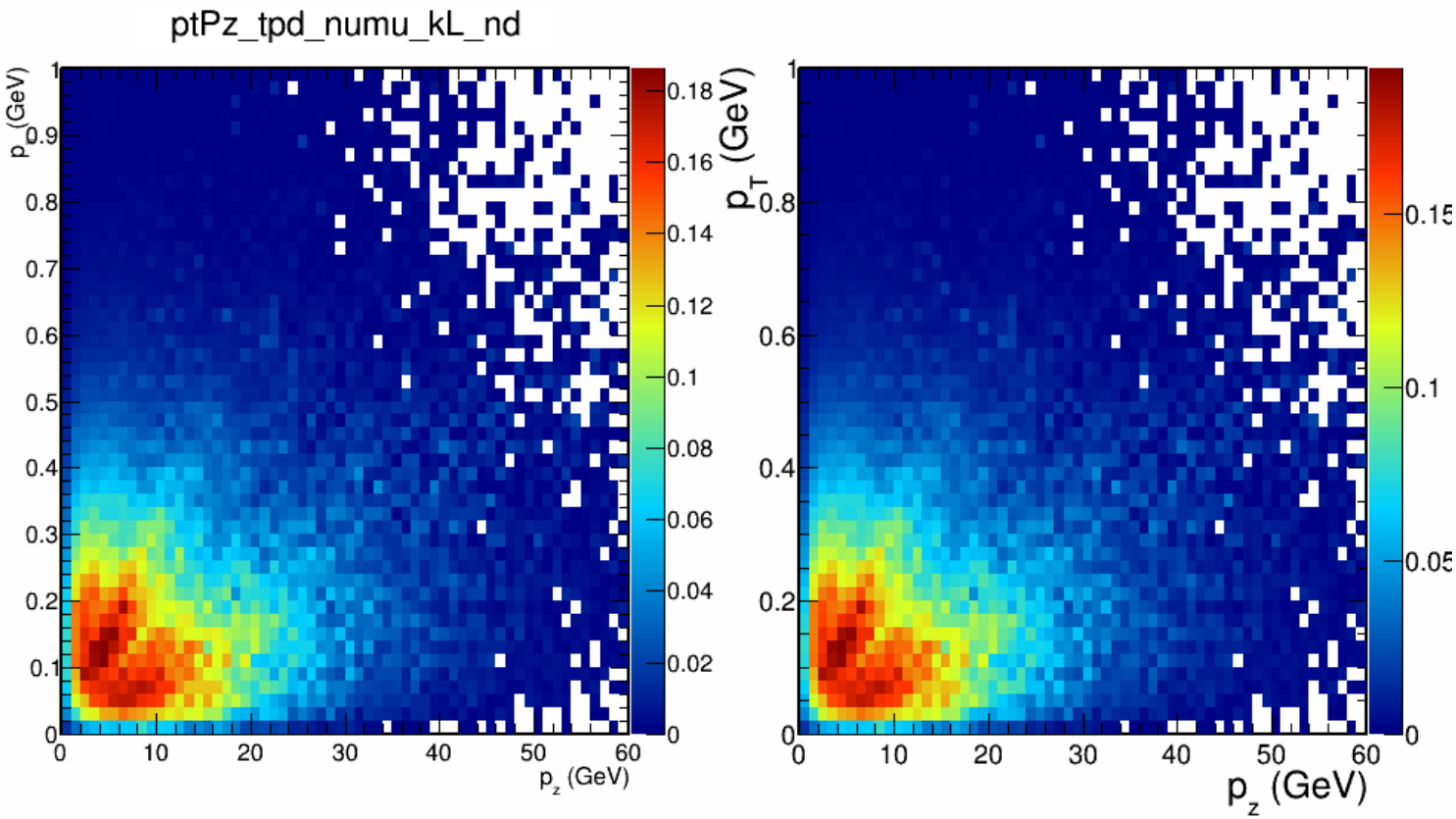

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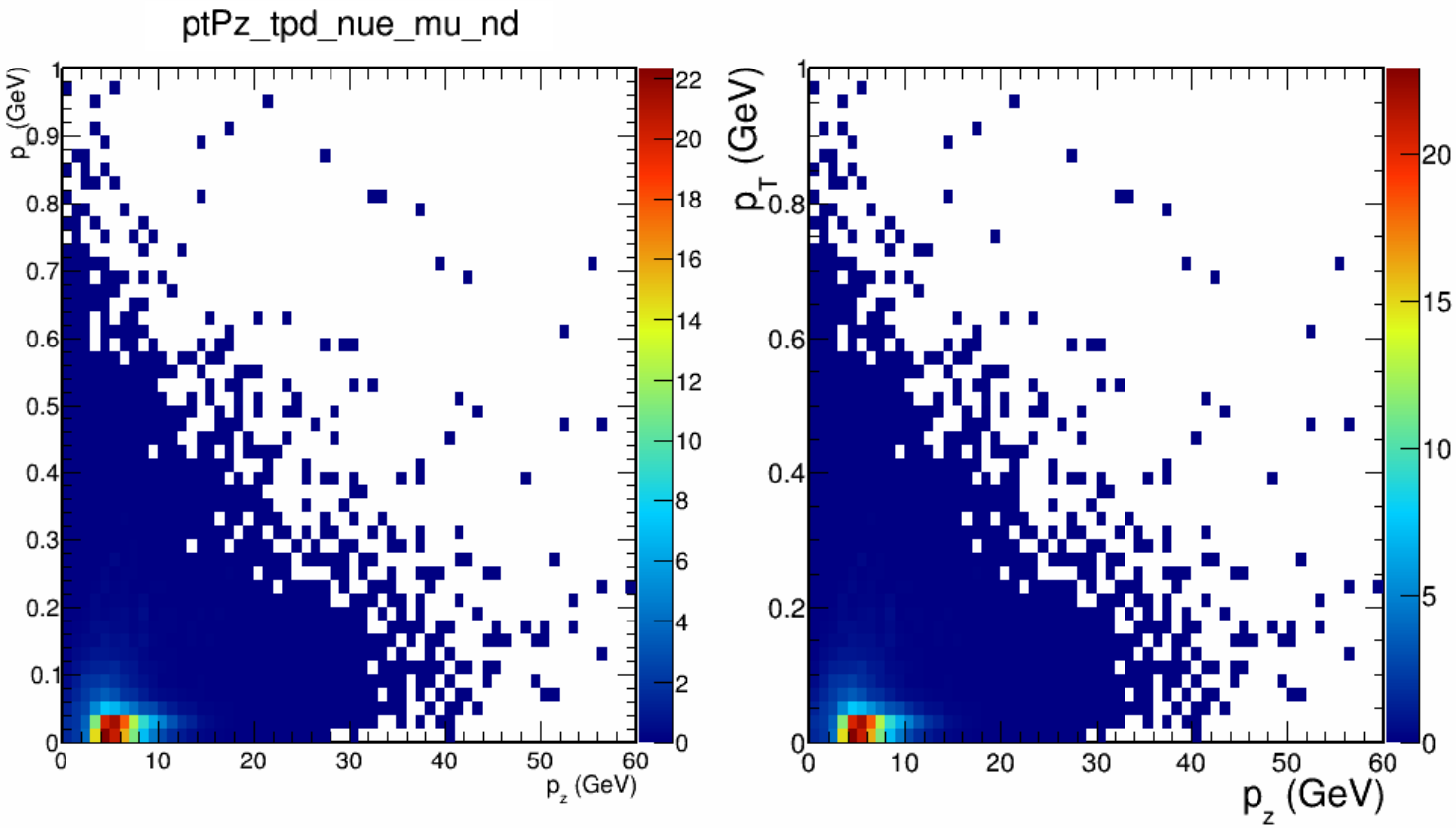

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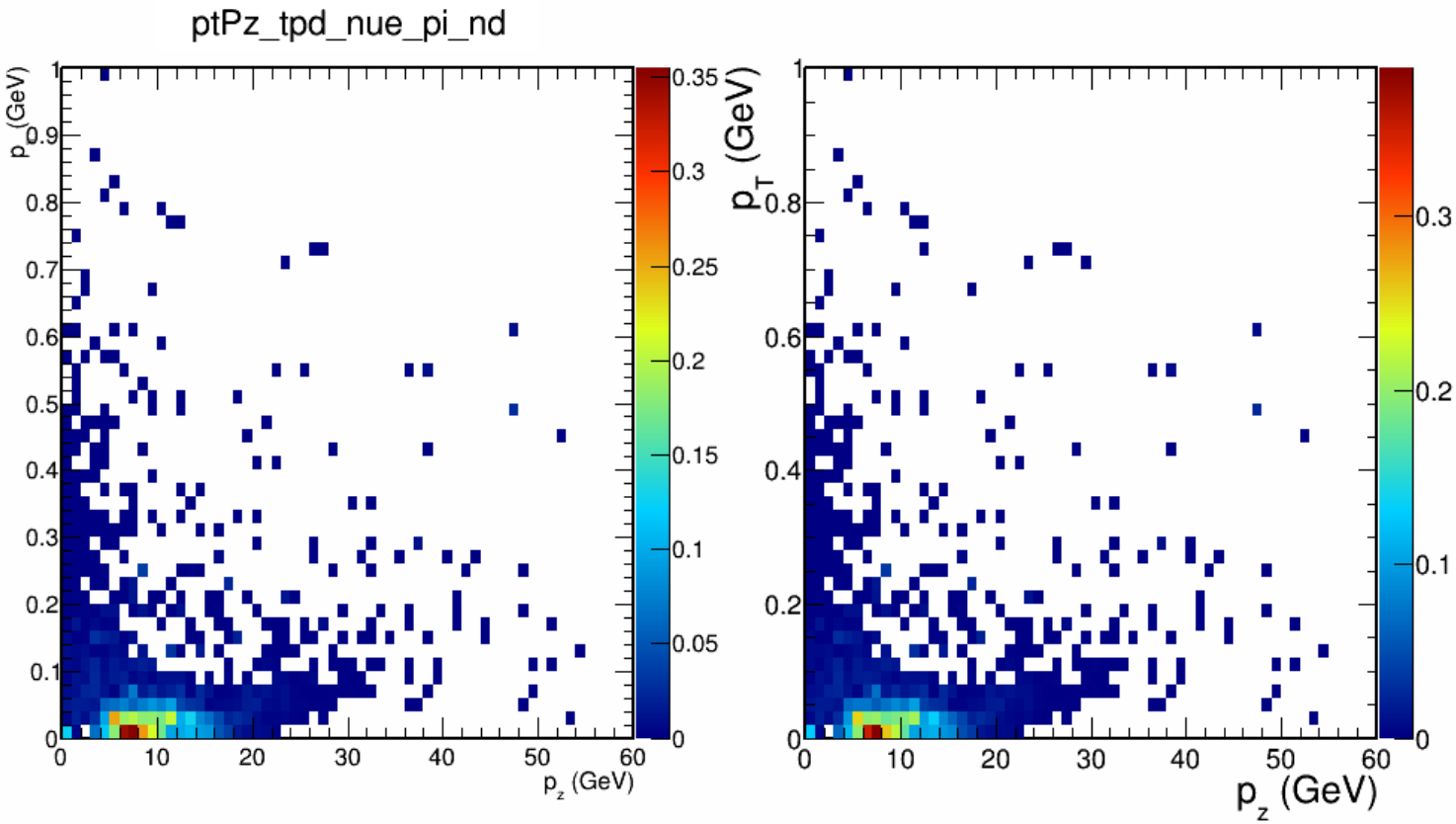

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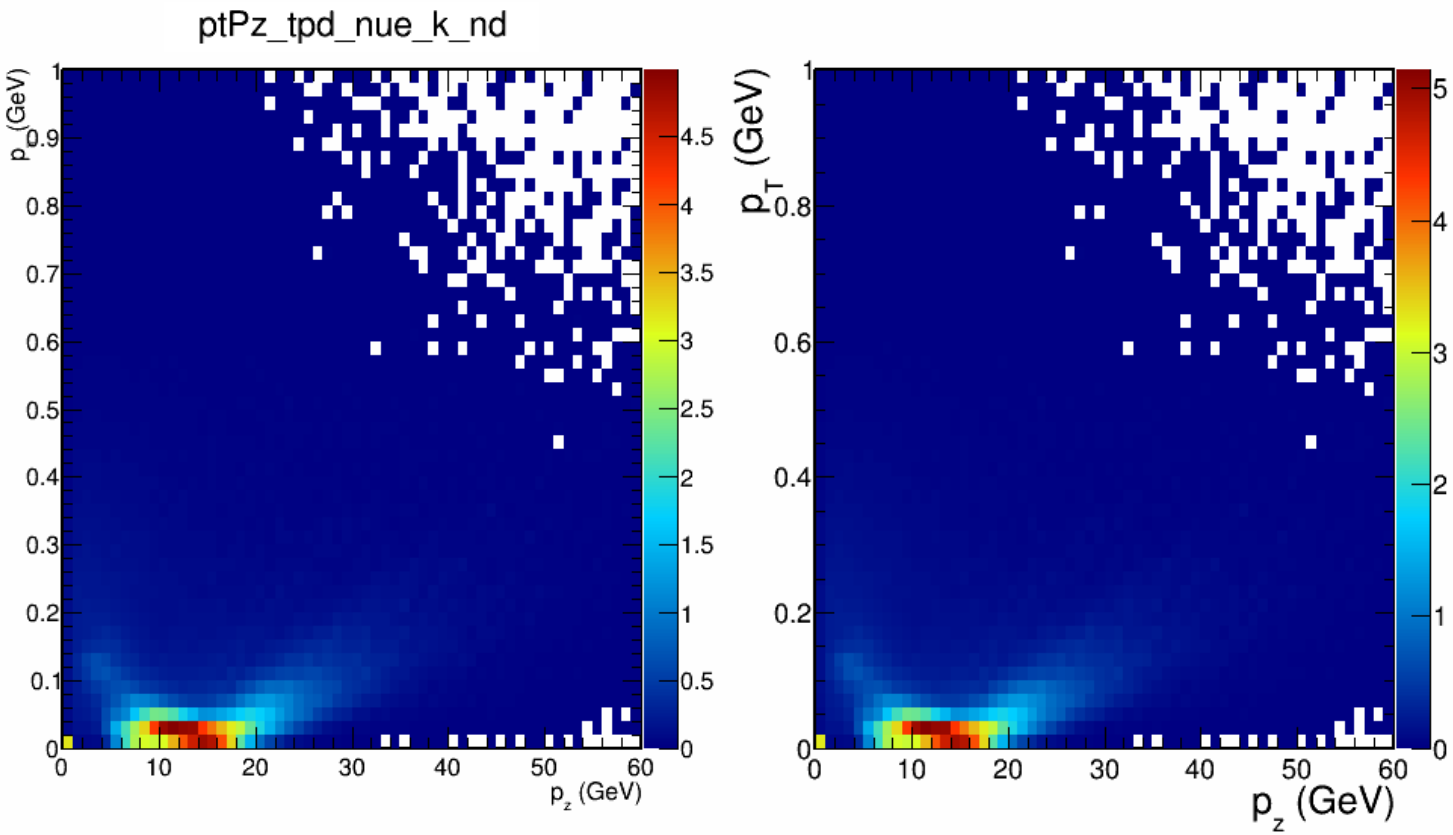

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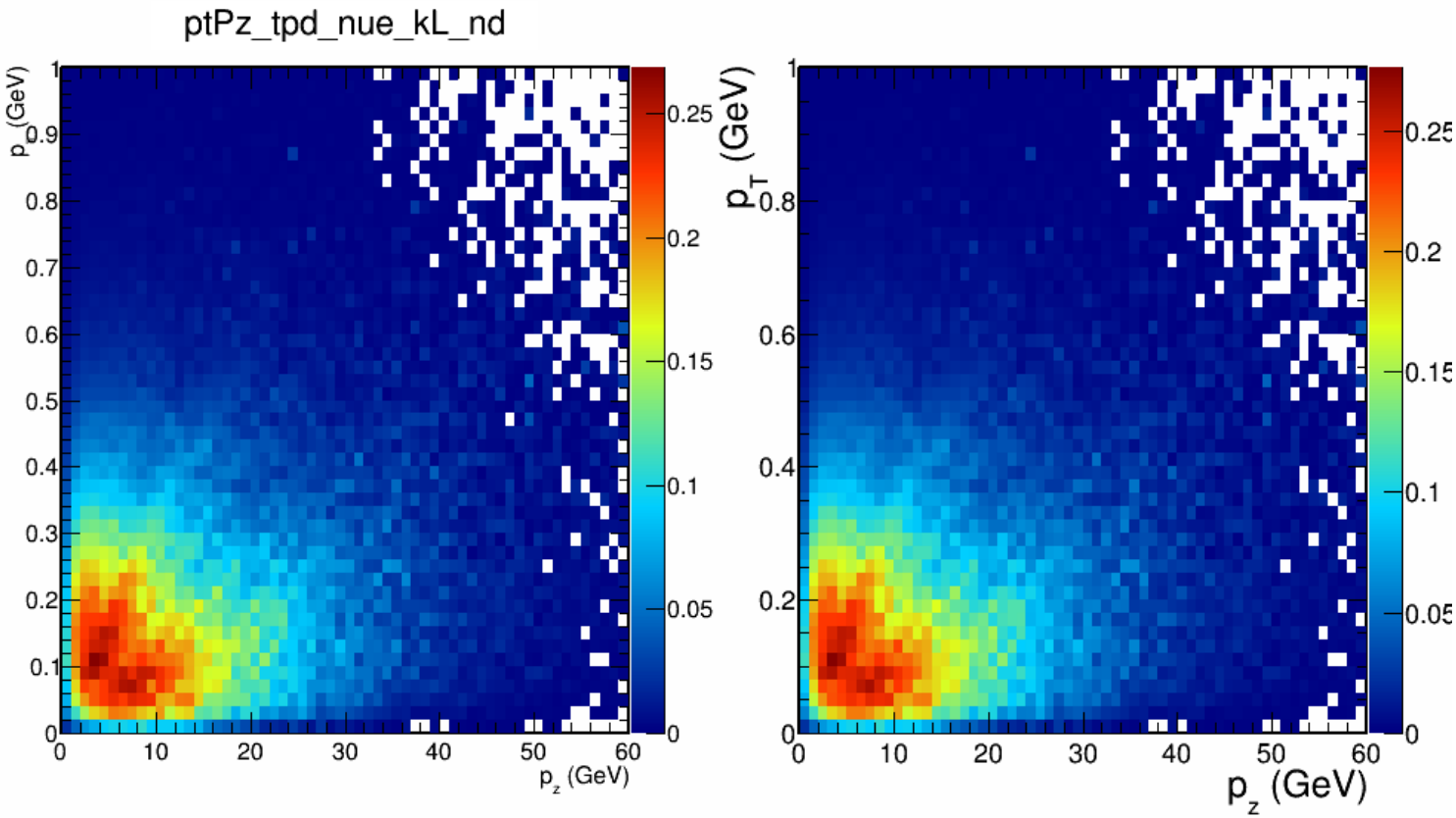

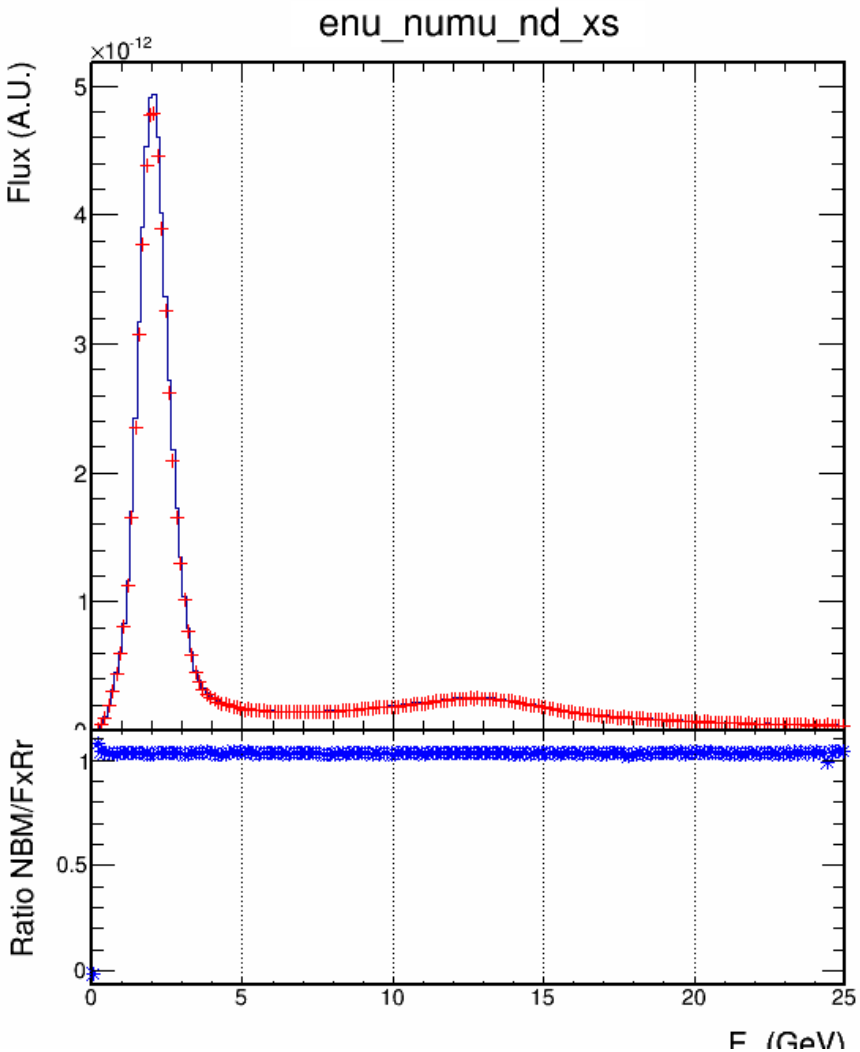
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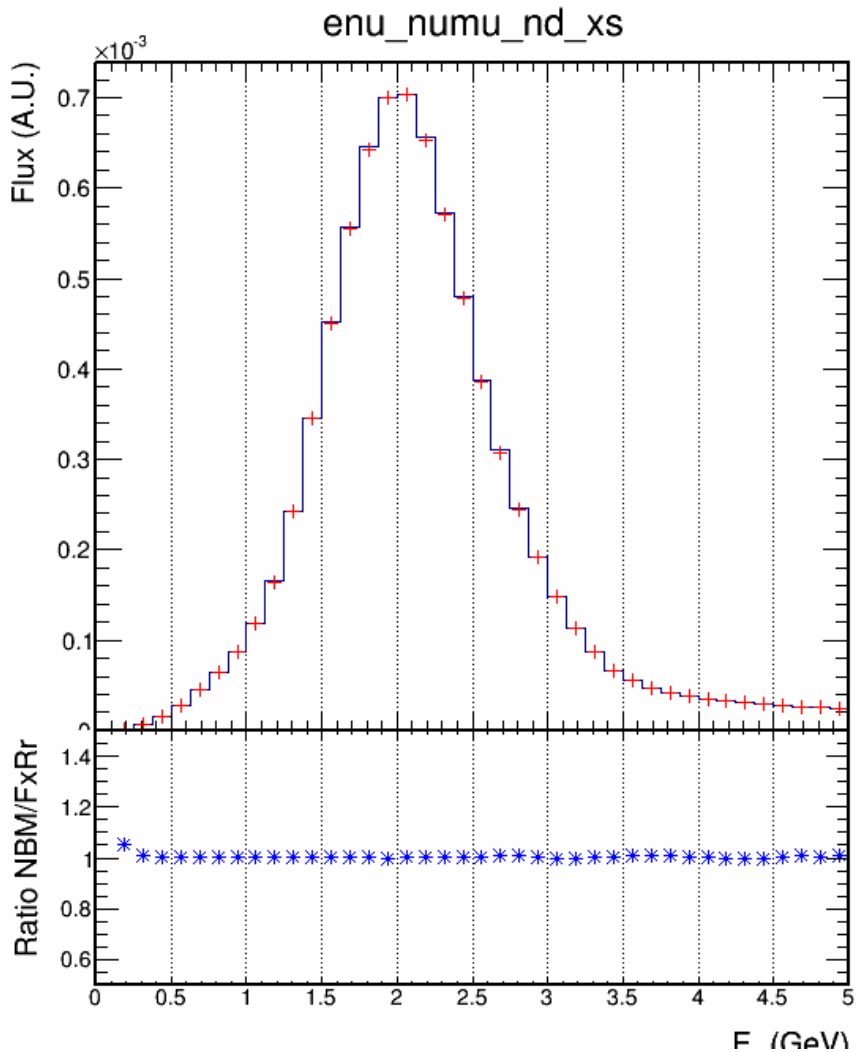
E (GeV)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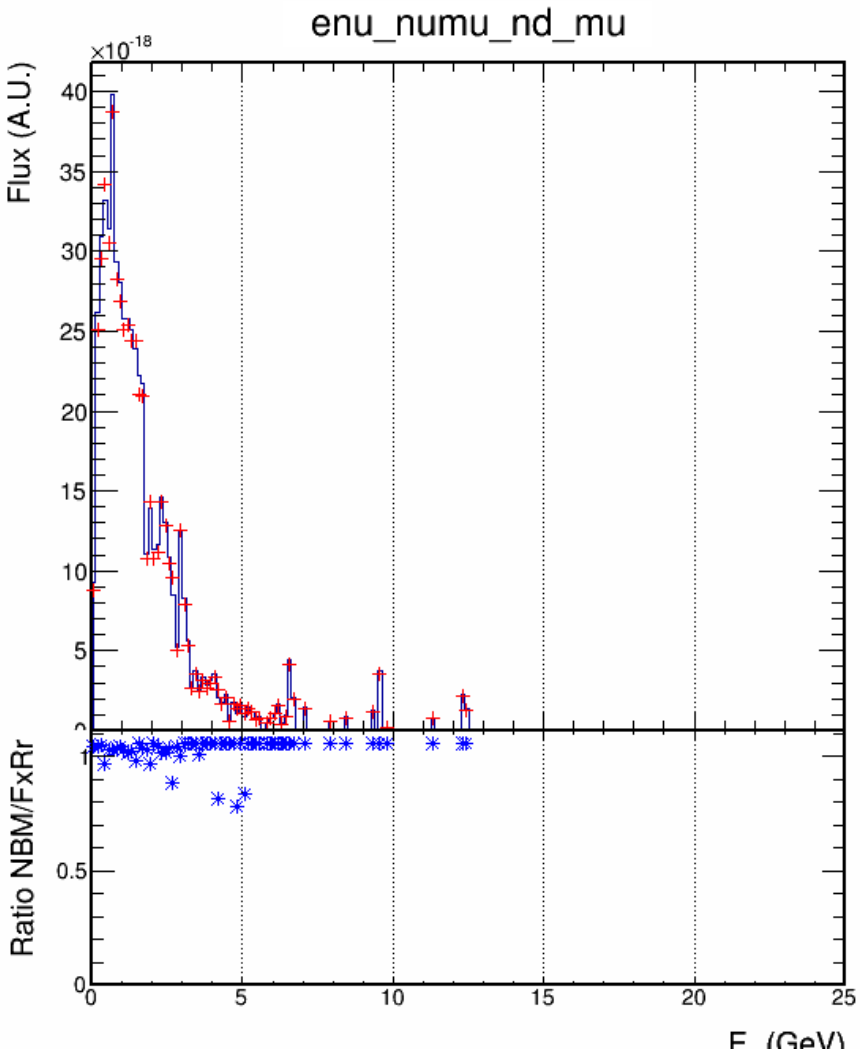
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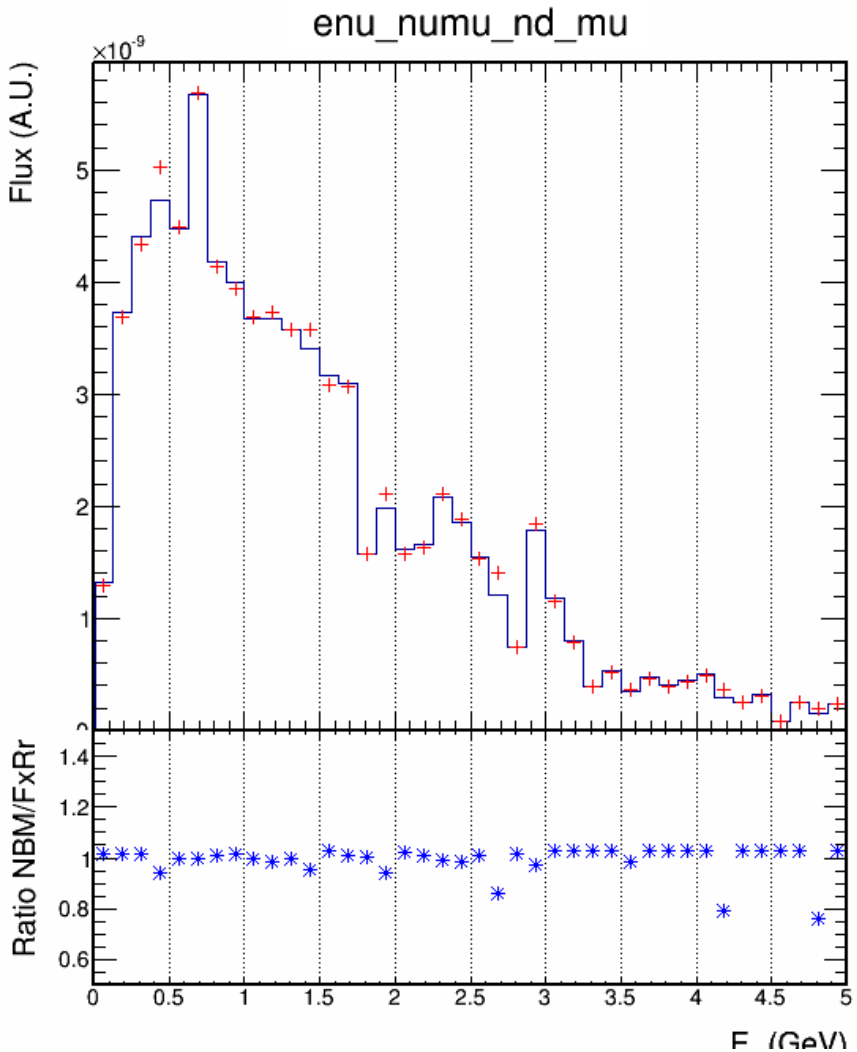
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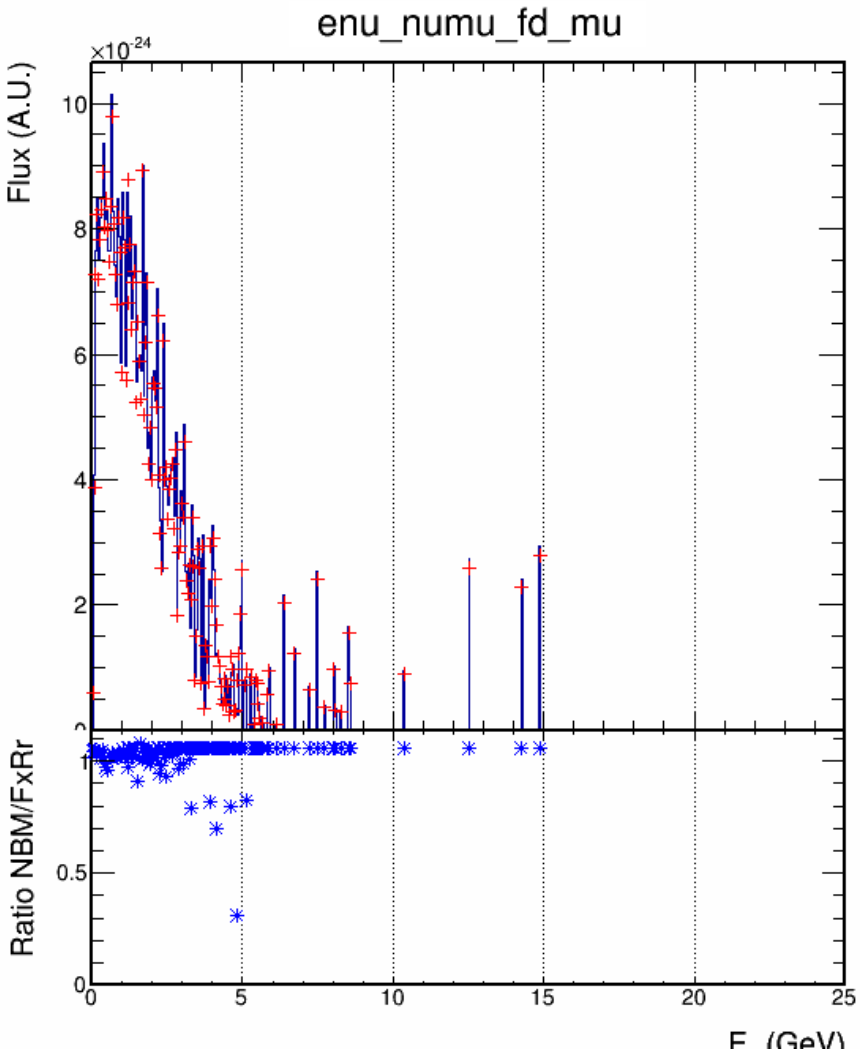
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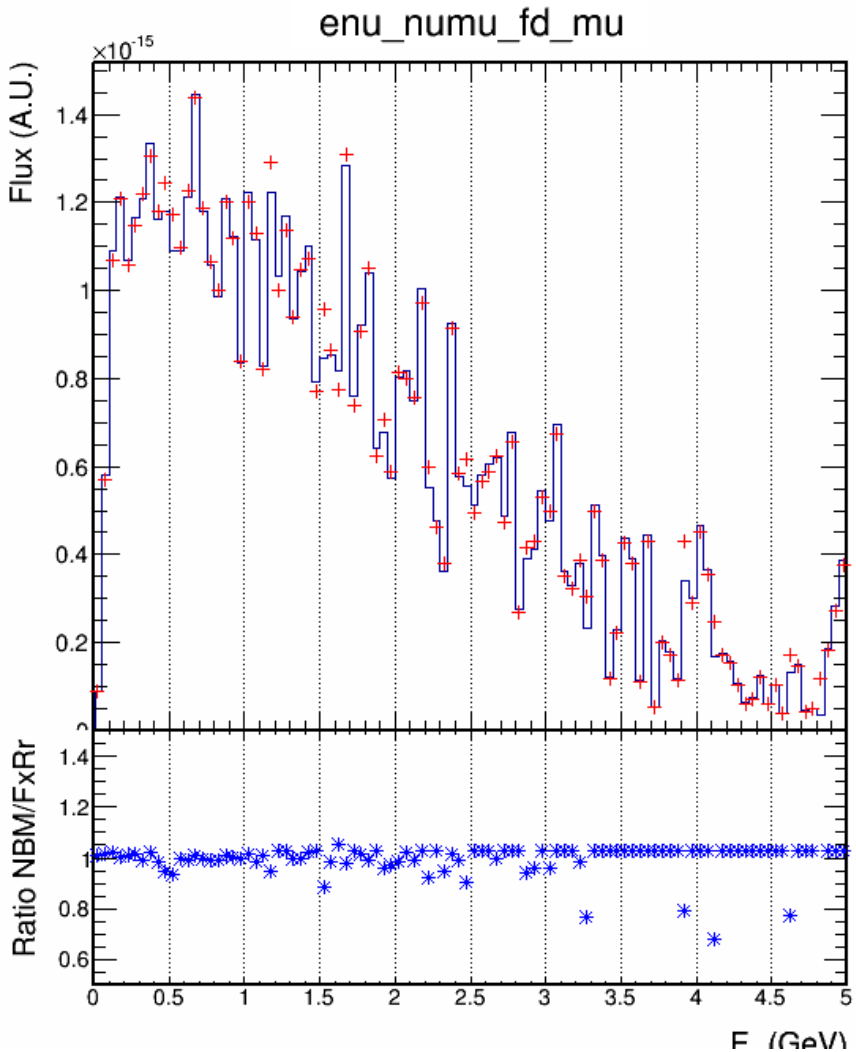
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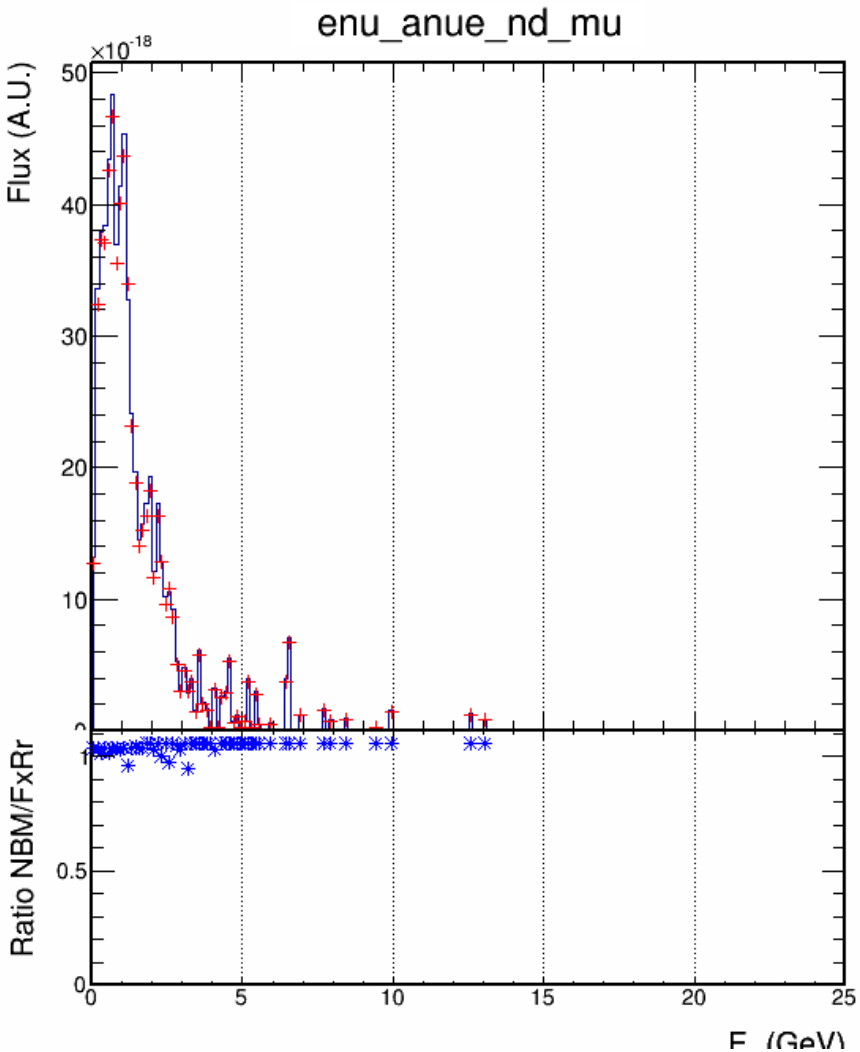
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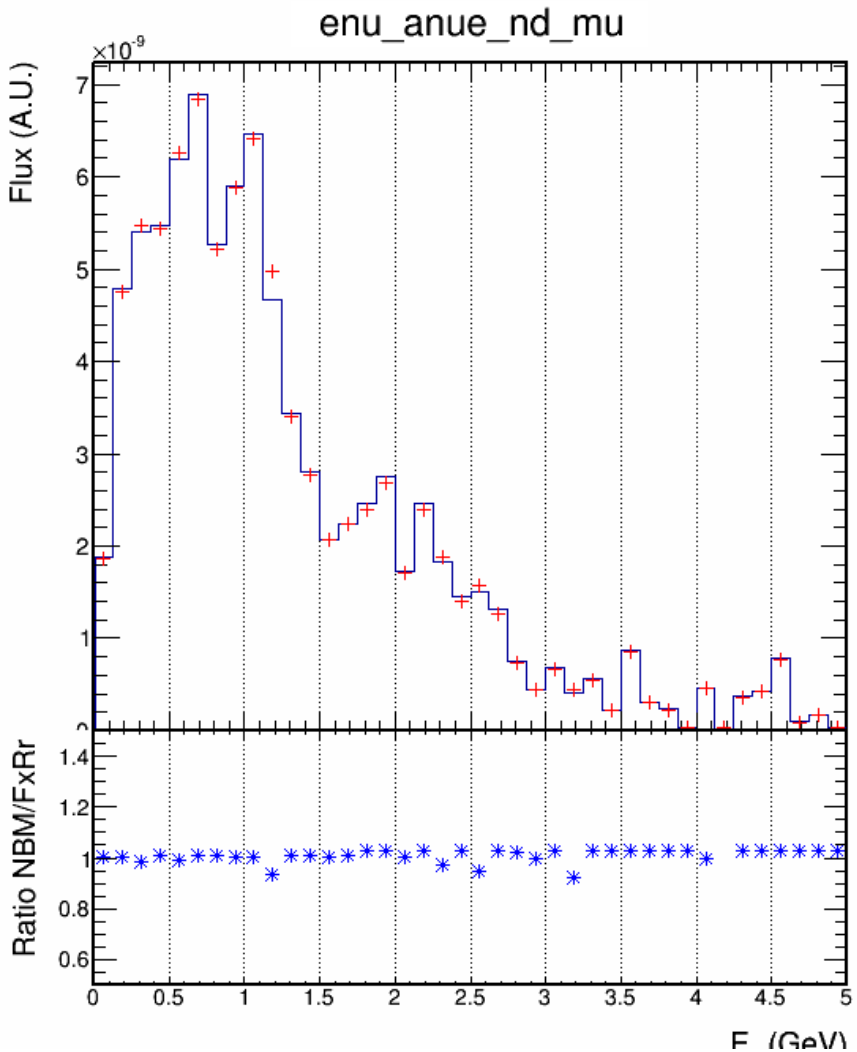
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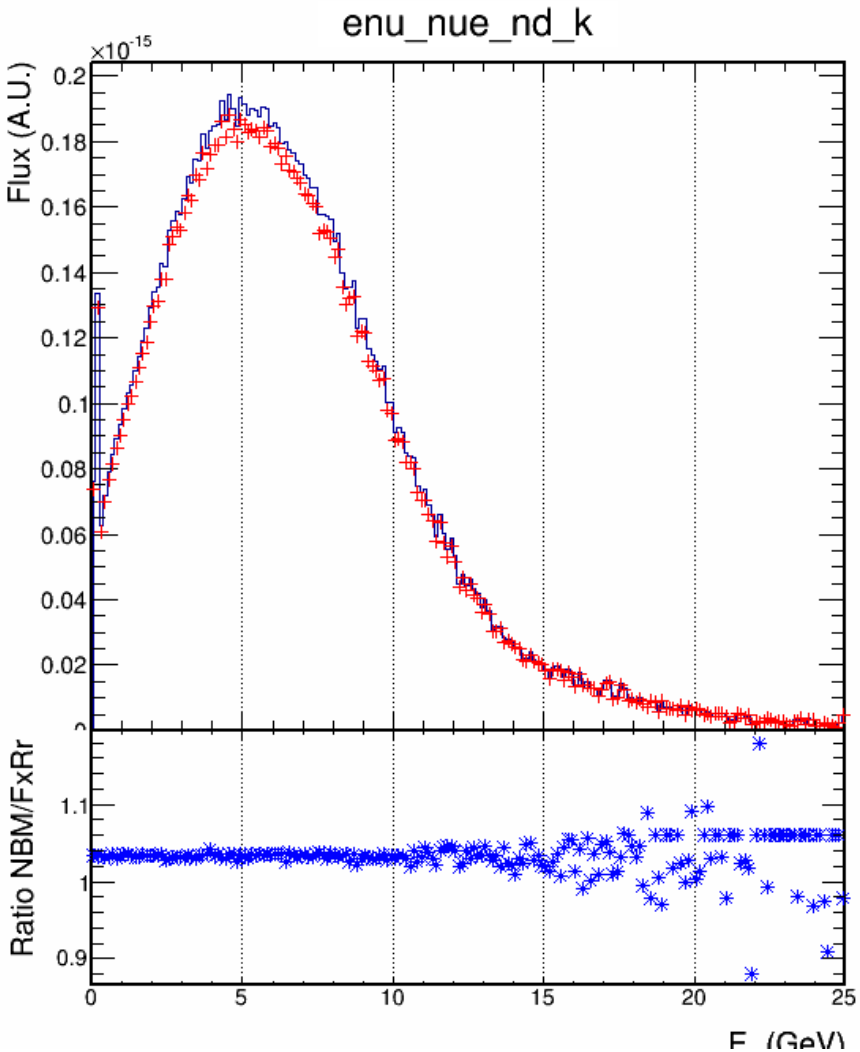
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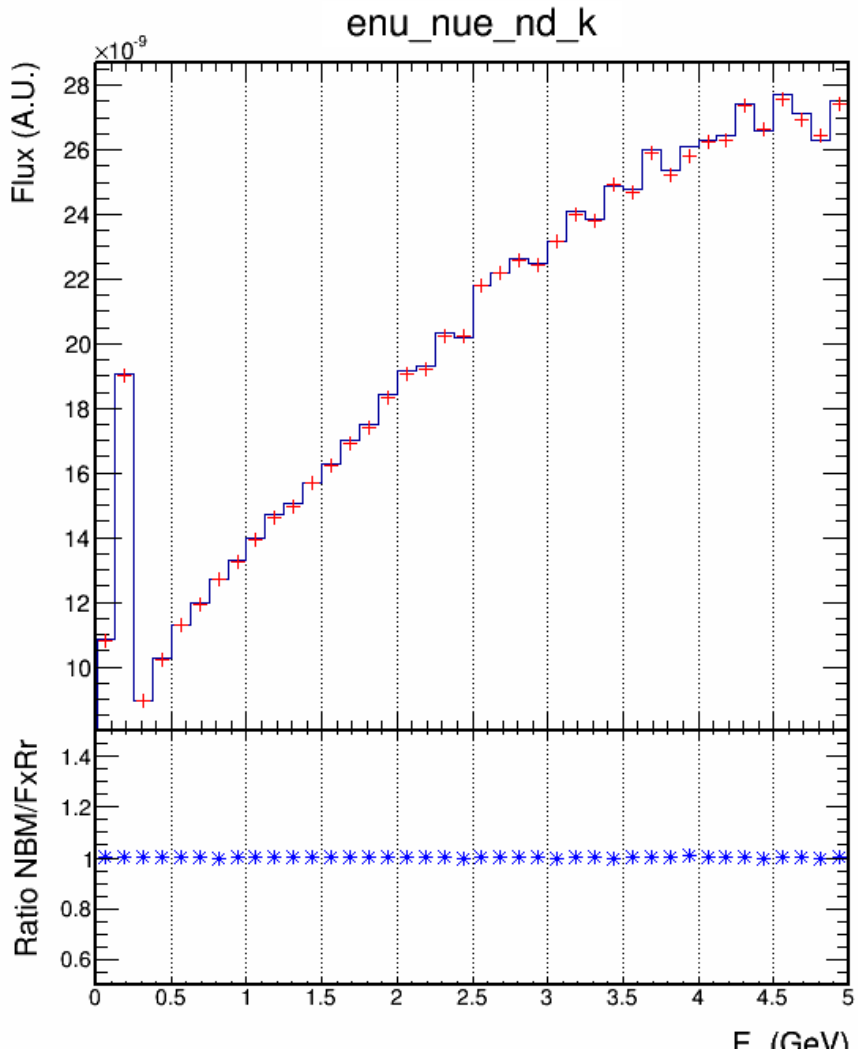
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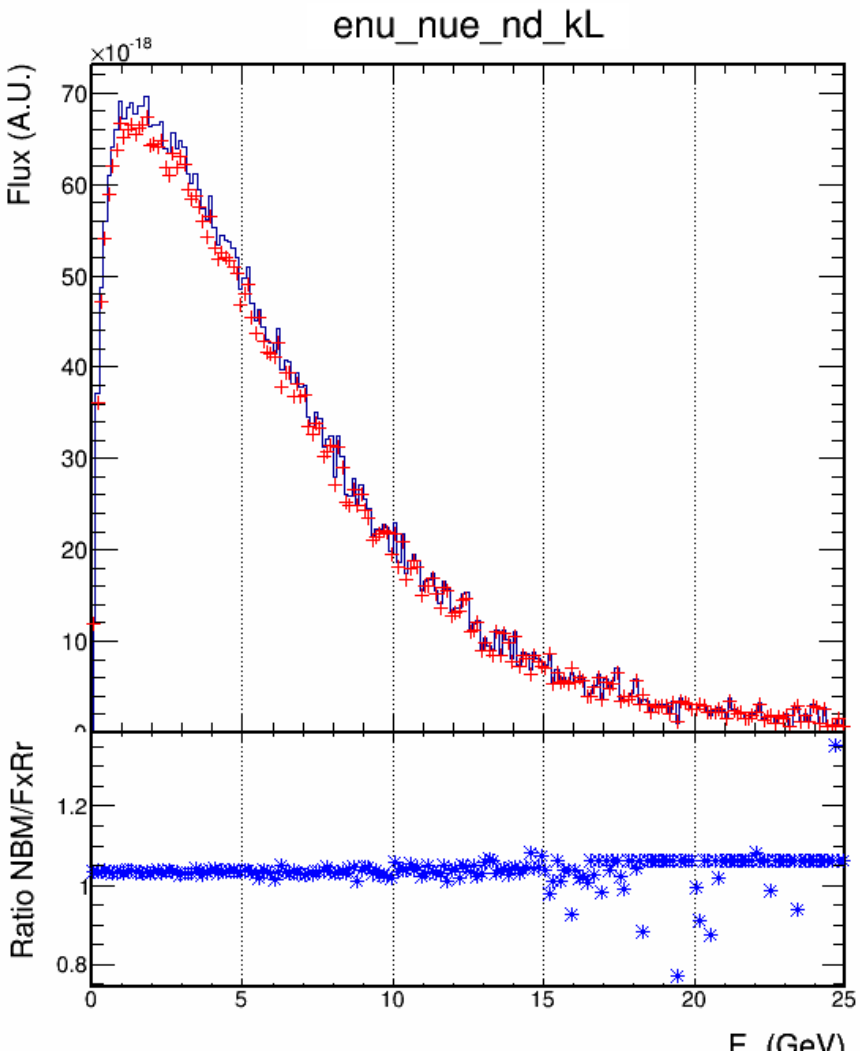
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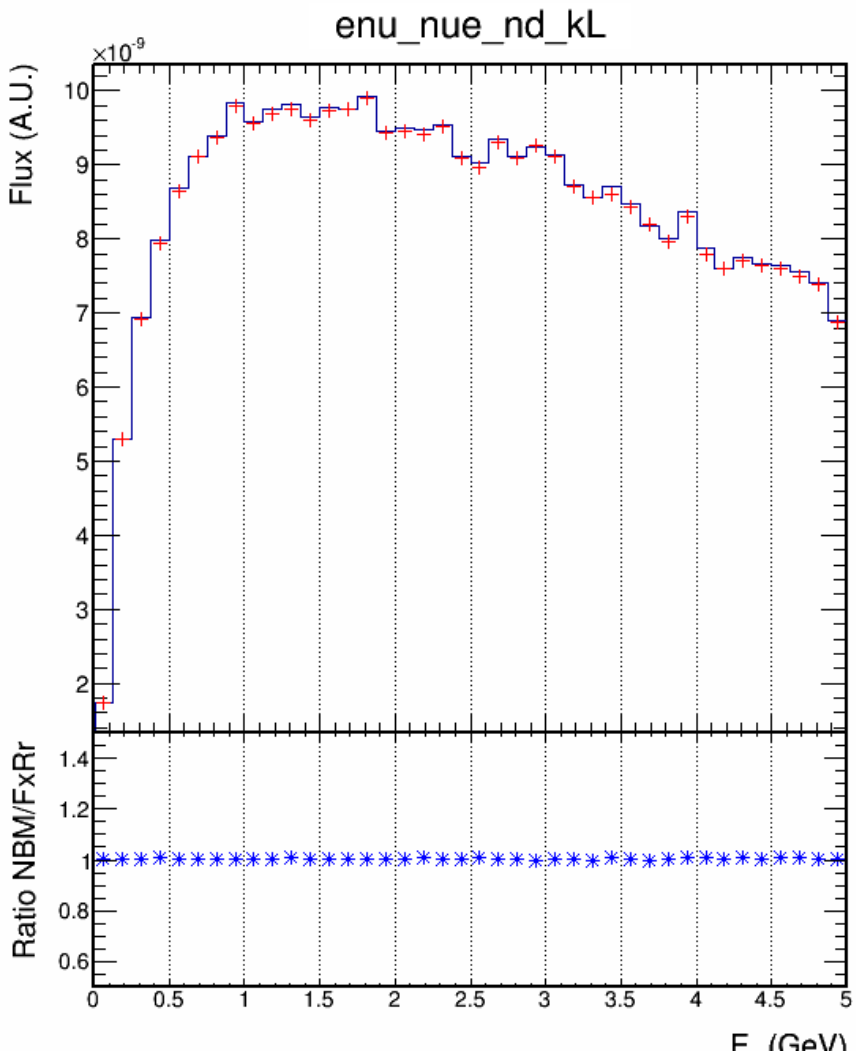
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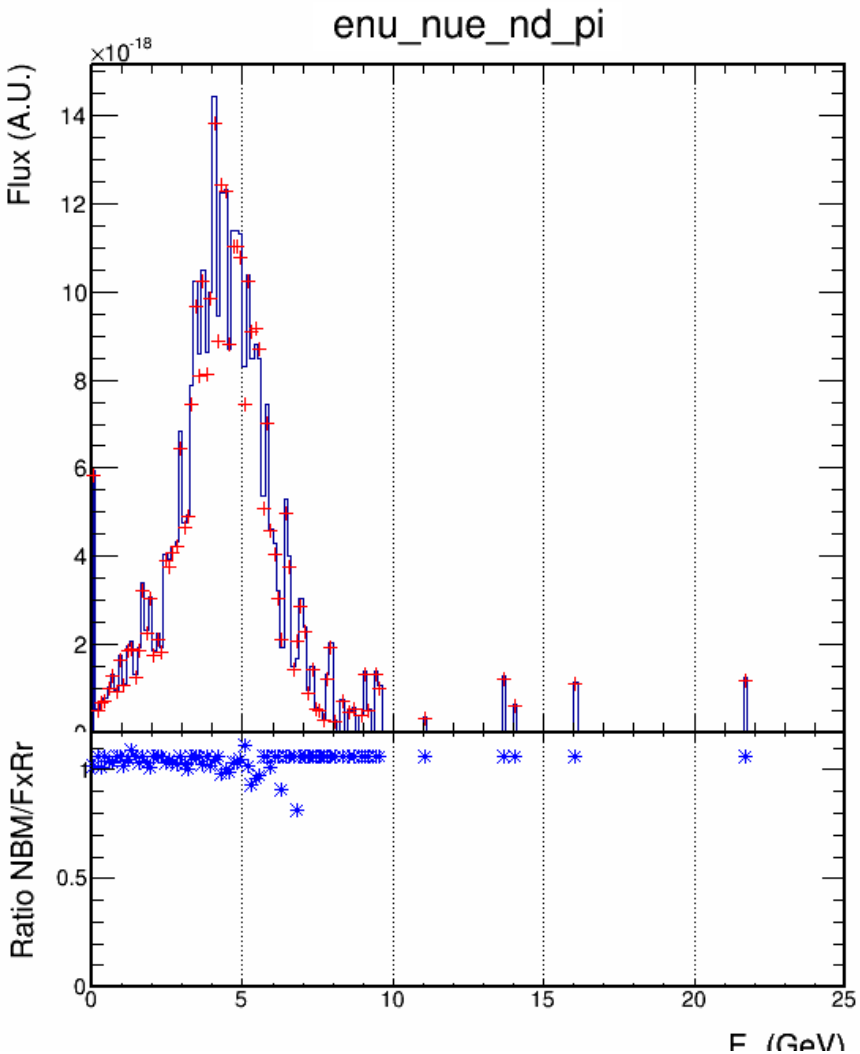
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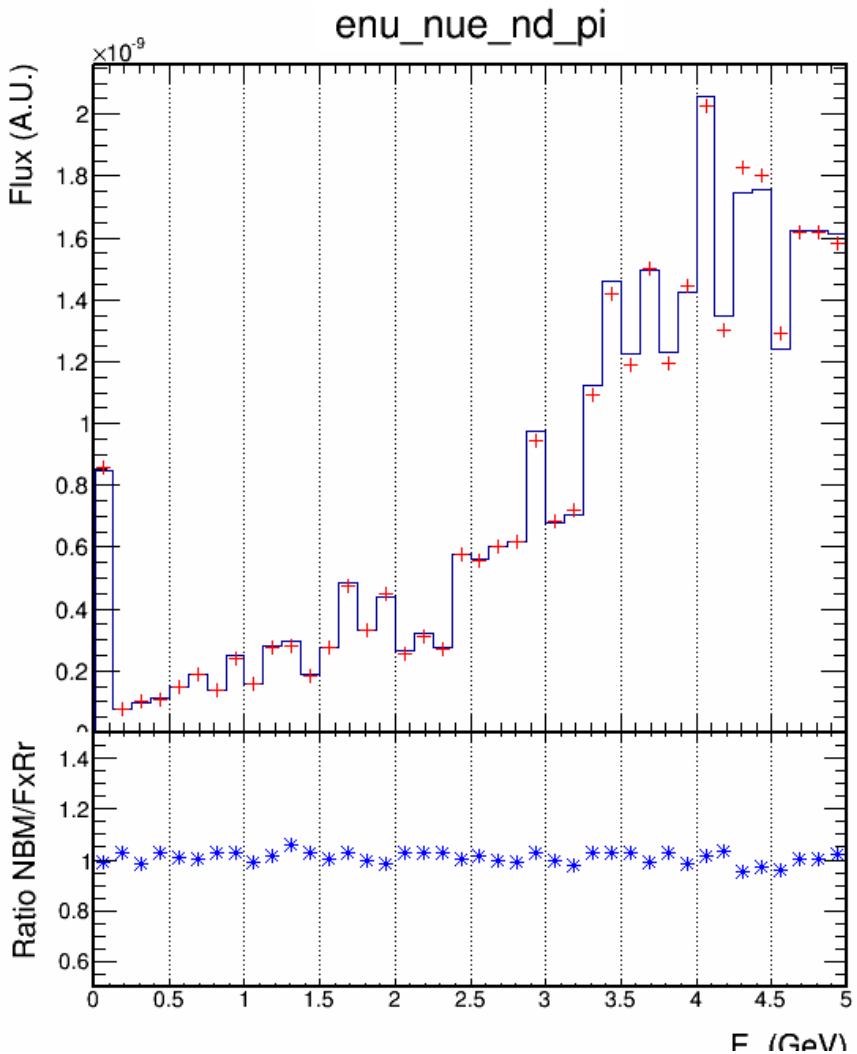
E (GeV)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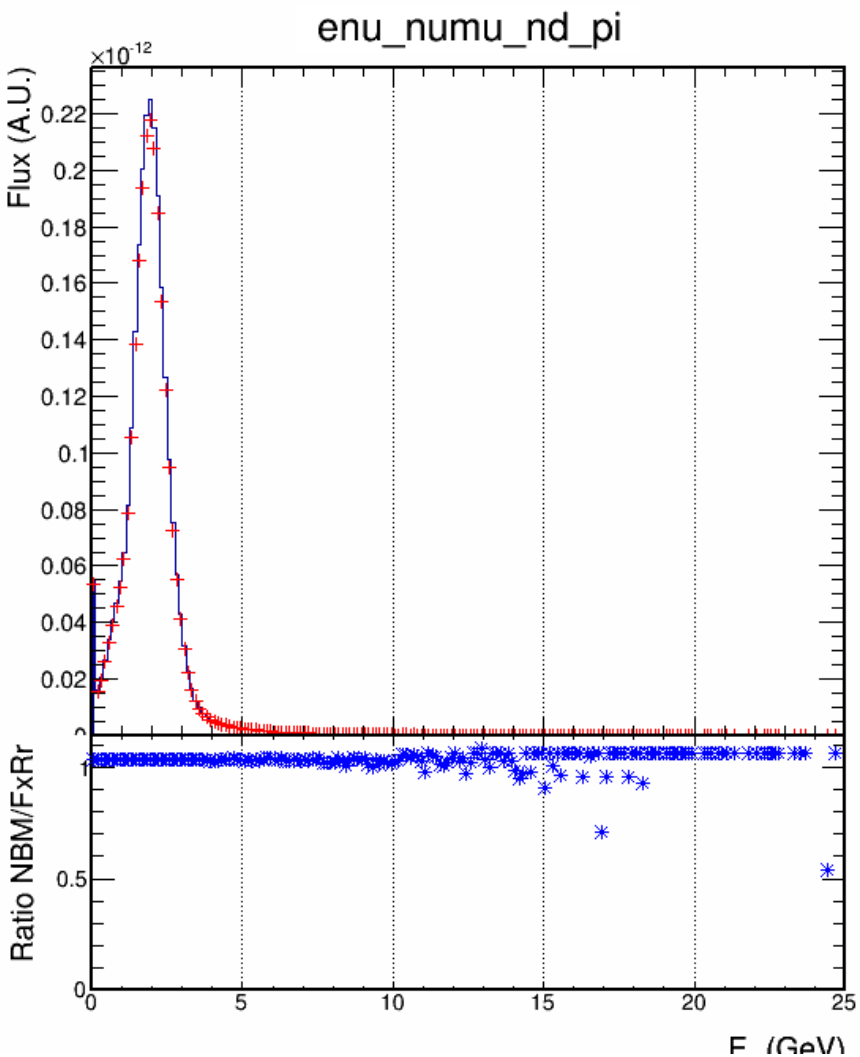
Ratio NBM/FxRr
E (GeV)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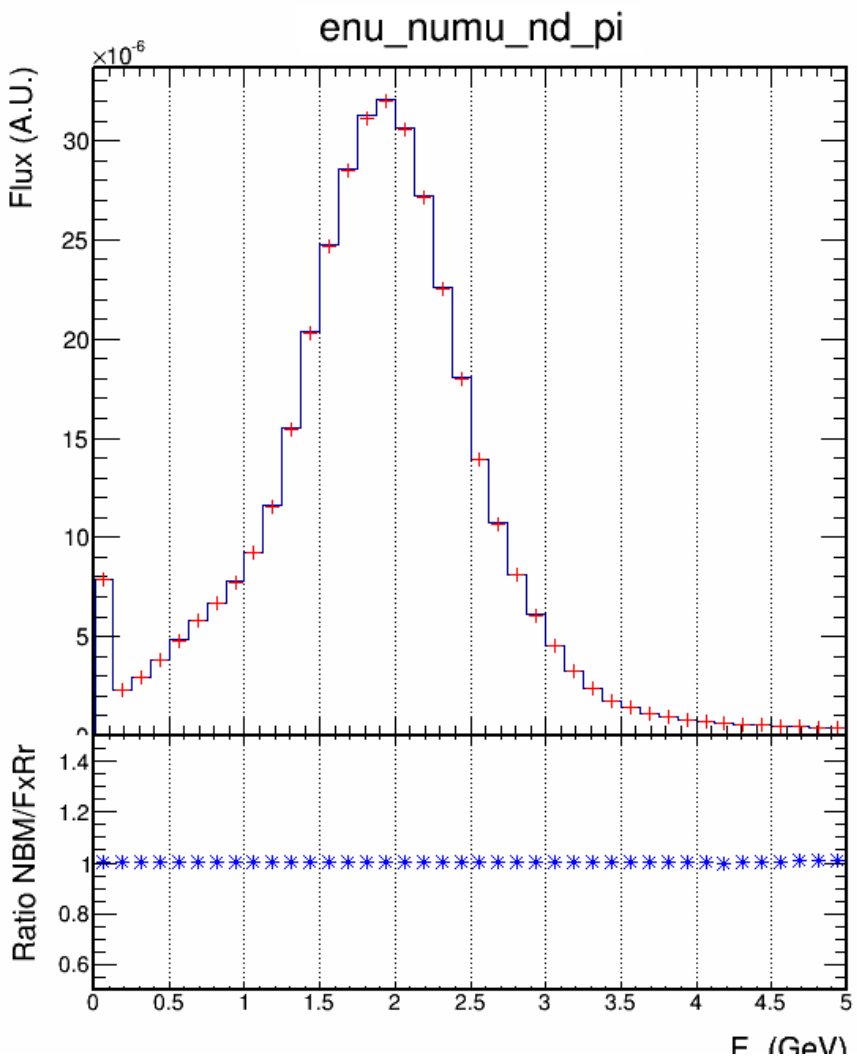
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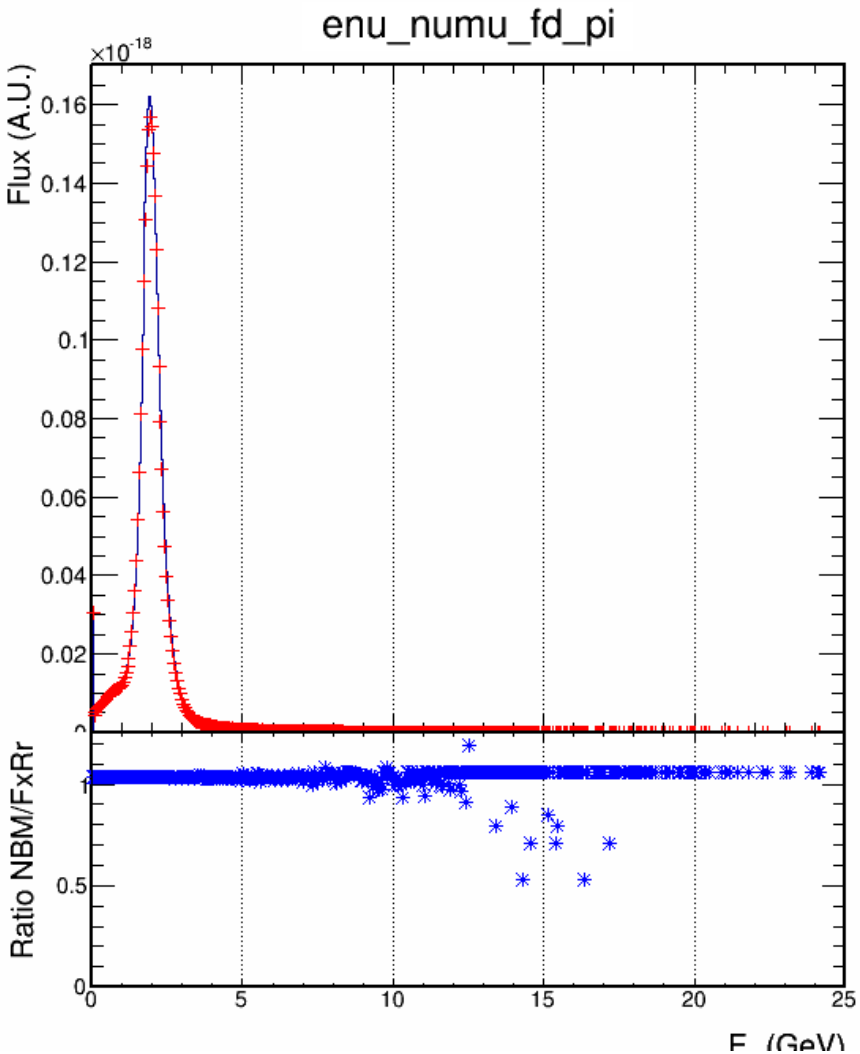
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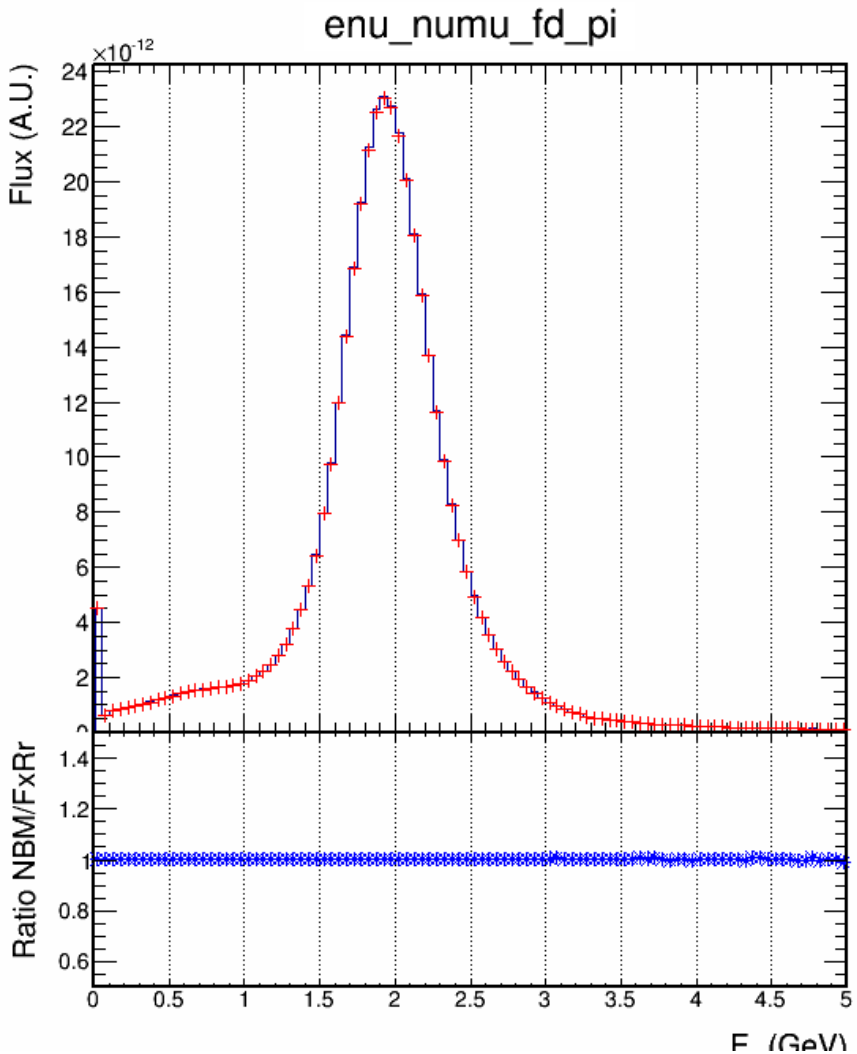
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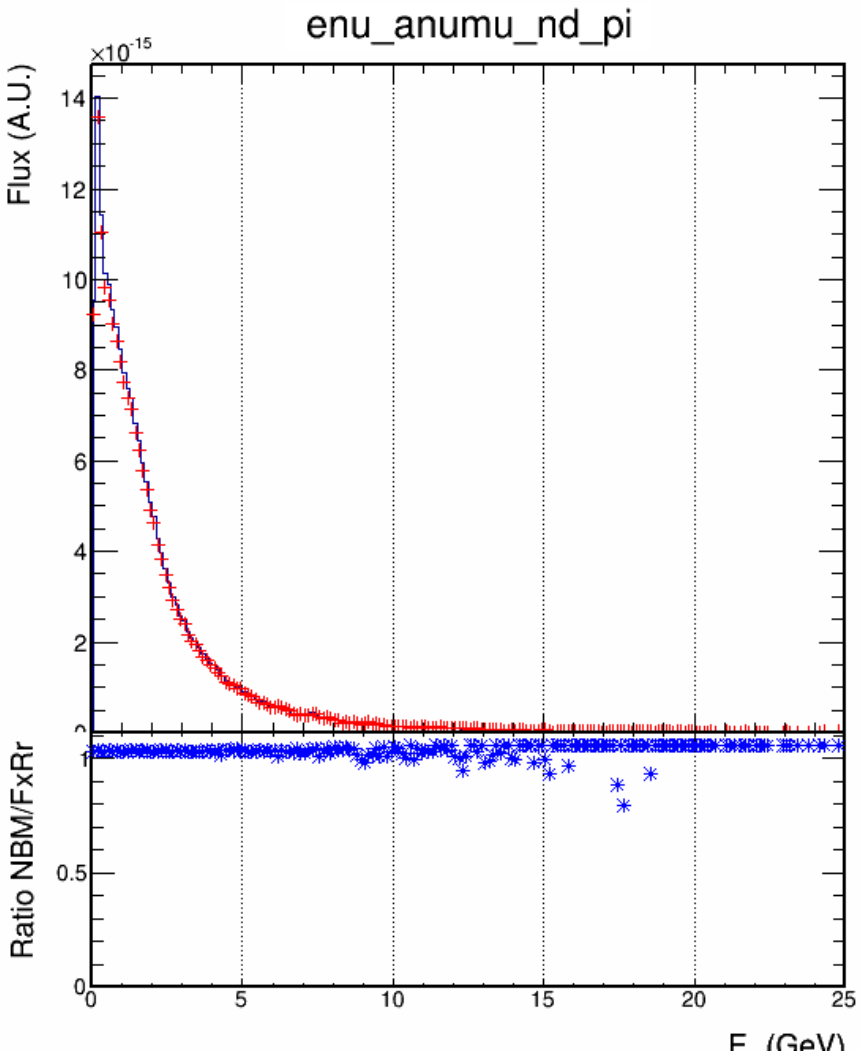
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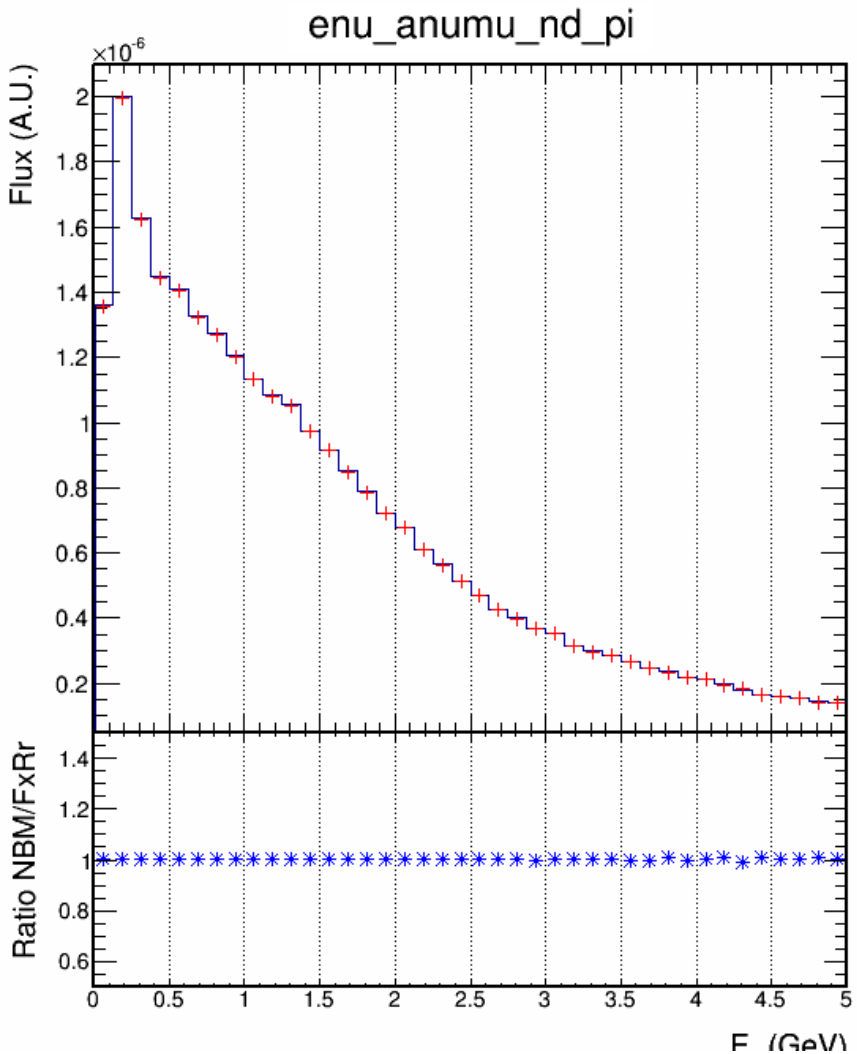
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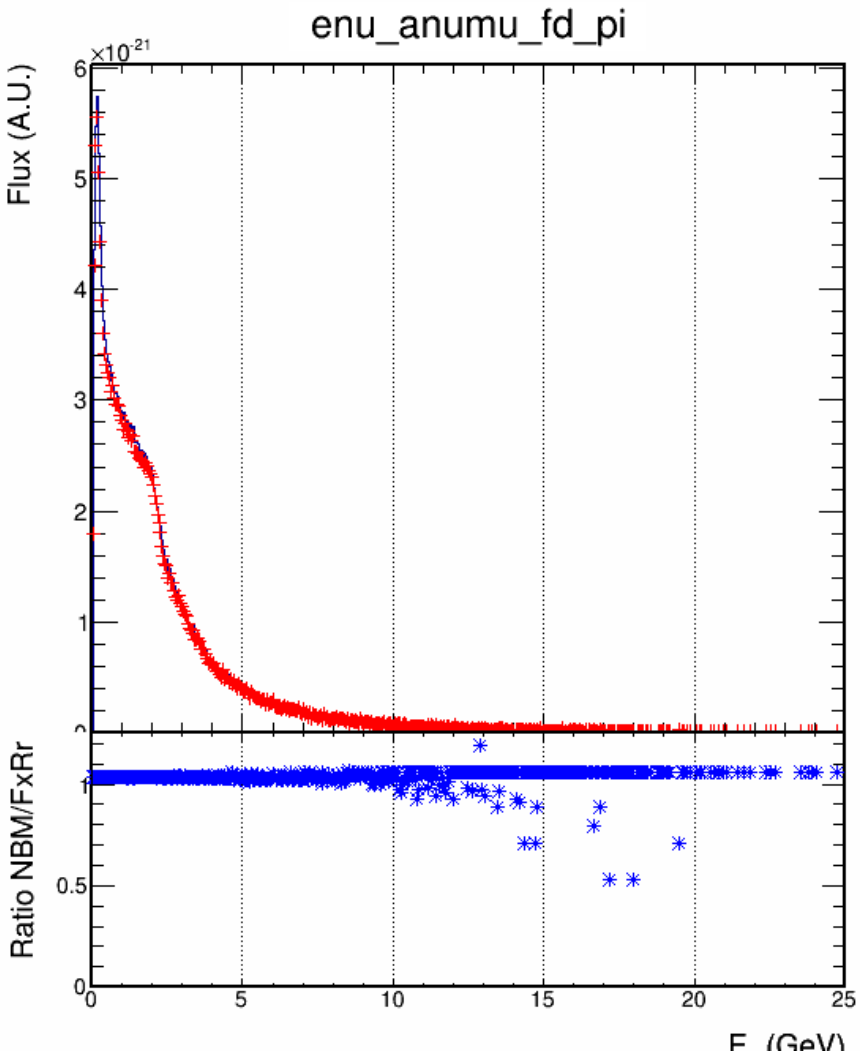
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Ratio NBM/FxRr
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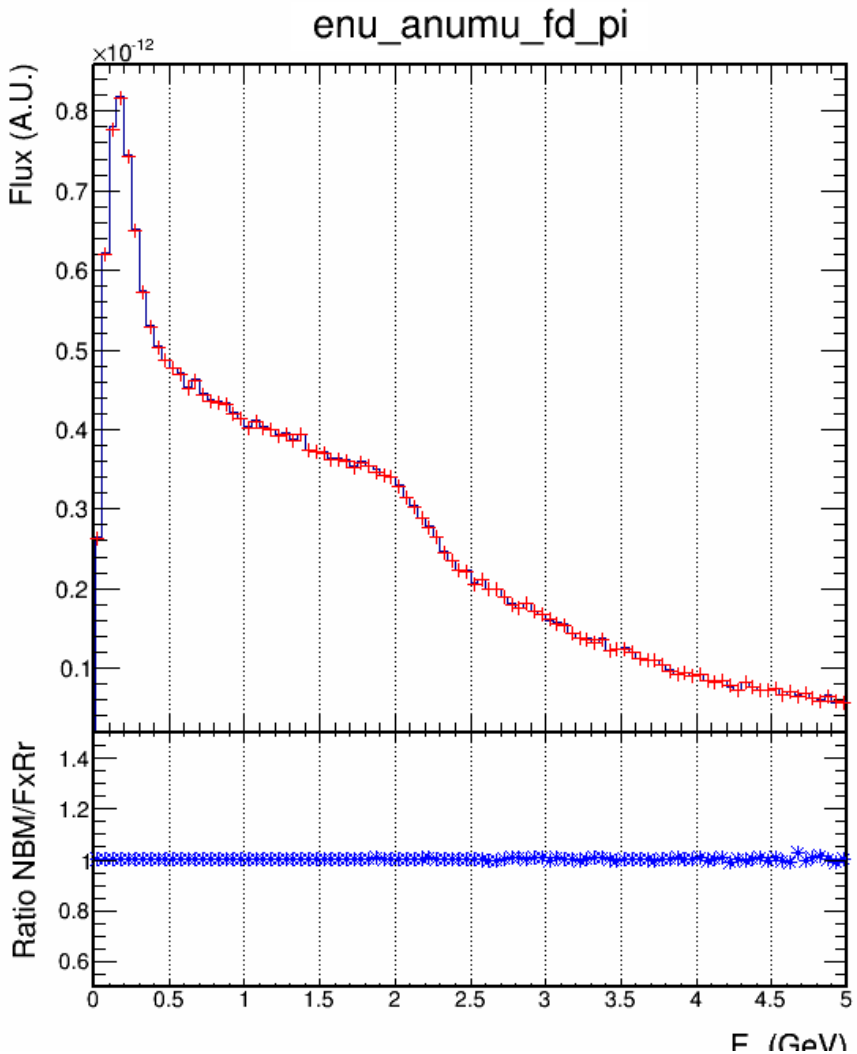
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Flux (A.U.)
Ratio NBM/FxRr
E (GeV)